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Electrical World

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An Executive's Response

I received your letter of March — just as I was leaving for A — for my talk before the Chamber of Commerce of that city. I had included reference to electrification in the remarks I had prepared for this occasion, and, in line with your suggestion, I interjected additional comments on the subject during the course of my talk.

I trust that my discussion of electrification covered what you had in mind when you wrote me. . . .

THE writer of the above letter is president of a great railroad now spending many millions of dollars on electrification. An ELECTRICAL WORLD field editor requested him to state why his company had decided to purchase power in addressing the 500 representative business and professional men attending the Chamber luncheon meeting referred to, and the response was an unqualified indorsement of power company service for this responsible duty.

The instance is but one of many ways in which the ELECTRICAL WORLD seeks to serve the industry of which it is an influential voice, and the willingness of a great executive to declare in so public a manner his faith in the service acceptable to his own industry through purchased power is pleasing evidence of the ELECTRICAL WORLD'S standing in other fields than those of its daily cultivation.

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Electrical World

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Maine Moves Forward

GOVERNOR GARDINER and the Maine Legislature have made a real contribution to the economic welfare of the Pine Tree State in the enactment of the Carleton-Smith bill providing for the exportation of surplus hydro-electric power. Maine is to be congratulated that constructive action has at last been taken, and there is strong expectation that the final seal of public approval will be placed upon this act in the referendum set for September 9. The measure provides for complete regulation of surplus power exportation by the Maine Public Utilities Commission, authorizes the organization of power-exporting corporations, establishes an excise tax of 4 per cent upon revenue derived from surplus power sold, and allocates 50 per cent of such revenue to the construction of rural electric service facilities for ten years, with a maximum of $250,000 per annum. Thus the excise tax is a rural service subsidy.

The power companies are now in a position to make the meaning of the act so clear to the public that no intelligent voter will have a shred of excuse for opposing it. The question of power exportation has been befogged so long by politicians using it as a means of self-advantage that no chances should be taken of losing at the polls the victory now won. The facts are indisputable as to the present waste of stream flow and the time has passed for further toleration of political buncombe in dealing with this problem. The strength of the vote in the Legislature for this bill indicates that it will have the backing of intelligent public opinion throughout the state in the coming referendum, provided that the facts are kept before the people. By this act the welfare of the largest state territorially in New England has been potentially advanced and the key to far-reaching economic progress put in the hands of the electorate.

* * * *

Preferred Voltages Call for Preferred Displacements and Sequences

ACCEPTED values for preferred system voltages take no account of phase displacement or phase sequence. These come into play when going from one preferred voltage to another and are of importance when two or more properties are interconnected at multiple points at one or more system voltages. On a single transmission interconnection of large capacity it may be economical to make arrangements to take care of phase displacement, but even in this case expenditures could be reduced if uniformity in practice can be had.

A variation in delta and Y connections between preferred voltages will give a positive or negative phase displacement of 30 degrees for each transformation, and, unless some agreement is had in the practice, it is difficult to parallel systems. For example, in going from 2,300-volt delta to 4,000-volt Y it might be a preferred practice to have a positive 30-degree displacement. For higher-voltage transformations agreement might be had to reduce the displacement to zero by using a negative phase displacement of 30 degrees; or it might be an agreed practice to have the Y side of transformations always positively displaced from the delta. Moreover agreements on phase sequence would save money for the industry.

So long as Y-delta transformations exist and cannot be dispensed with, it seems obvious that the next step in voltage standardization should be to provide for a definite phase displacement and phase sequence for each of the steps in the preferred voltage system recently adopted. This is a task that calls for committee activity whereby existing practices could be studied and a decision rendered that would be agreeable to the industry.

* * * *

State or Federal Courts?

FOR the utility industry at large the most important point in the decision handed down last week by the United States Supreme Court in the case of the Interborough Rapid Transit Company of New York City is not its finding that a five-cent subway fare had not been shown to be confiscatory but its declaration that the action of the lower federal court in New York State in issuing an interlocutory injunction restraining the New York Transit Commission and the city of New York from interfering with the collection of the proposed seven-cent fare was "improvident and beyond the proper discretion of the court."

"The Transit Commission," the Supreme Court says, "has long held the view that it lacks power to change the five-cent rate established by contract, and it intended to test this point of law by an immediate, orderly appeal to the courts of the state. This purpose should not be thwarted by an injunction."

Whether the highest tribunal of the land so intended or not, this dictum and the general purport of the whole decision will be popularly construed as an indorsement of the view that except in grave emergencies utility companies have no proper right to go to the federal courts for relief from alleged confiscation until they have first taken their grievance through all the steps of legal procedure afforded by the state courts. Two or more bills to make this the law of the land have been introduced in Congress in recent years. They have failed to become law, and this failure has been quite generally welcomed by utility companies, many of which have taken advantage of the "short-cut" remedy sometimes

provided by the federal courts against unjust municipal or commission decisions.

In the light of last week's pronouncement by the Supreme Court, will the utilities' methods of fighting nonremunerative rates as violations of the Fourteenth Amendment have to be changed?

* * * *

Standard Service Voltages and Power Applications

WITHIN the limits of safety and satisfactory operation there is no one service voltage that stands out conspicuously on account of inherent virtues that exist in it alone. Such virtues as any of them have are not absolute but are relative between themselves. Discussions of the merits of service voltages of 125, 120, 115, 110, are discussions of declensions of none too well-defined curves, and it is a hard job to find the point of maximum economy where all the curves intersect. That point probably does not exist. Final agreement will probably come to rest on neutral ground.

Speculation aside, there are some phases of the situation that have not yet been fully discussed—have, perhaps, been overlooked, or maybe have not yet been reached. They have to do with power service voltages. The consequence of raising the general service voltage from 110 to 115 is to push more kilowatt-hours through existing lamps, flatirons and other domestic bric-à-brac. If the lamp potential is raised from 110 to 115, then the power voltage is raised from 220 to 230 or from 440 to 460. What happens, then, to the underloaded motor? Most of the motors in use today are underloaded. The reactive current increases and the power factor drops. The bad effect of lowered power factor more than offsets the good effect of increased voltage. Starting currents are disproportionately increased. Those vexatious devices, fractional-horsepower motors, will become more obstreperous.

There is no intent here to make the job appear more difficult than it really is. One only wants to be sure that all of the factors will be nicely co-ordinated and no forgotten element cause confusion like a piece of crockery that a juggler fails to intercept despite all his dexterity.

* * * *.

What Price Accuracy?

ABILITY quickly to determine the necessary degree of accuracy required in a specific task is part and parcel of every expert's qualifications for leadership in dealing with clients in the financial world and in convincing executives in his own field that his findings and judgment are sound. To the less experienced engineer, and often to the seasoned accountant, the cost of excess accuracy does not occur. The former tends to rely upon the soundness of the applied principles without regard to their practical limitations, and the latter not infrequently carries his machine-made computations to a point which actually impairs their value in the perspective of the recipient.

In a recent report to a regulating commission a municipal plant manager turned in a production cost per kilowatt-hour carried out to the hundred-thousandth of a cent. The computation was made by a certified public accountant, and its absurdity as to decimals did not occur to any one prior to its scrutiny in the commission's office. Taken in itself, this would be too trivial an instance to deserve comment; but taken as a symptom of wasted effort, of careless judgment and of poor psychological approach to the executive desk, it is significant.

These cases are multiplied in many places in connection with such matters as the unit cost of wire and cable on construction jobs, mileage costs in utility transportation service, fuel costs per unit of weight and per unit of output, coal-purchase reports, and the presentation of many data bearing upon operating averages. Where good co-ordination exists between engineering and accounting departments, these examples of false accuracy are being largely done away with. The price of carrying computations beyond the practical needs of the problem in hand may be small in individual instances, but when multiplied over a long period it is far from negligible. From the slide rule to the research laboratory runs the pathway of engineering practice.

To determine how far down this course it is necessary to go to solve a particular problem adequately for the economic circumstances prevailing is a responsibility too often overlooked.

* * * *

Another Attack on Power-Company Merchandising

A MANUFACTURER of electric refrigerators has just stepped into the spotlight by bringing suit in the federal courts of an Eastern city to enjoin the local power company from selling domestic appliances at retail. At the same time he has filed a complaint with the Federal Trade Commission denying the right of public utility companies to compete with independent merchants. He has broadcast over the country a printed pamphlet denouncing the merchandising policies and practices of the power companies and setting forth a long correspondence with the commission and with various retail trade associations. As the complaint of one individual against an industry, this pamphlet is probably not important. But coming as it does as the latest expression of an indignant criticism that for several years has been more or less continuously voiced by the retail merchants of many trades that sell electrical appliances in many states, it becomes undeniably serious.

Seven specific charges are made to show that power-company merchandising is unfair competition:

1. That the utilities, having been given a monopoly in their service, are in a favored position with respect to their customers.
2. That merchandising is not a necessary incidental to the conduct of their principal business.
3. That utility capital should be used for rate-base purposes only and that to apply it to merchandising is taking an unfair advantage.
4. That utilities by selling only a few makes of any appliance discriminate against other manufacturers.
5. That utilities offer special selling inducements in premiums, discounts and terms that cannot be given by other dealers.
6. That some utilities sell only those appliances made by themselves or by closely affiliated manufacturers.
7. That since the courts have prohibited the railroads from engaging in the coal business, it is illegal for utilities to engage in the manufacturing or merchandising business.

These are sweeping statements that come into immediate conflict with the central-station school of thought. Each one of them calls forth an answering argument

based on the peculiar conditions existing in the electrical market today. The strength of the argument for either side lies in the difference of viewpoint with which each side approaches this common problem. It is well, therefore, in any study of the case to brush aside the equally sincere contentions of both sides and ask the simple but compelling question, What is the public interest in the situation?

Obviously, the public is only concerned that there be a dependable electric service available at a reasonable cost and that desired appliances be purchasable at convenient points and on good terms. By and large, the average woman does not care from whom she buys them so long as they prove satisfactory. It is in the public interest also that the uses of electricity be broadened and extended because this will bring a greater enjoyment of this public service and in turn, by improvement of load factor and increased income per customer, will make lower rates possible.

The power company's chief interest lies in the building of load. If there were any one else to shoulder the burden of developing the public demand for electrical appliances, it is probable that few utilities would merchandise. They have been obliged to go into appliance retailing because some one must put an impelling pressure behind this idea of using electricity for more comfort and labor saving in the home. It requires the free investment of money for the upbuilding of a popular demand. The independent dealer cannot afford to invest his money in this way. Moreover, it is the very nature of retail trade that the dealer's store must sell what people want and come to buy. He is not organized for pioneering new ideas. The power company can do this, however, because, once sold, an appliance continues to consume energy from which a further profit is realized. And so the power companies have gone into the appliance business.

Provided that the power companies' policies are right, it is very much to the advantage of the independent dealer to have them actively selling appliances. It hastens the development of an active popular market. It makes more business for everybody by influencing more people in that community to use electricity in more ways. But in too many cities power-company merchandising policies are not right because the utility men in their zeal to sell more appliances have ruined the market for everybody else by selling on unmeetable terms. They have done this, not to hurt the dealers, but because they are comparatively inexperienced in trade. They have come in conflict with both the economics and the ethics of modern merchandising by failing to recognize their responsibility to the local trade of which they have become a part. They have overlooked the fact that if complete electrical equipment is some day to be the standard of the American home, there must be good and prosperous stores selling appliances in every neighborhood. And obviously the power company does not want to be compelled to maintain all the stores. It will be better if ultimately it can be relieved of merchandising altogether.

The present outburst of this particular refrigerator manufacturer may be helpful. It presents another proof of the danger of careless merchandising policies that make enemies of all the dealers who rather should be encouraged to enthusiastically sell load-building appliances to every home. Of course, the court action is local. Moreover, it is hard to see how the Federal Trade Commission has any jurisdiction unless all business that crosses state lines is to be put into the commission's control. The contention that a utility must sell every make of range or flatiron or be guilty of discrimination appears absurd, because no store could attempt to sell everything without becoming a museum.

But underneath it all is a serious situation. It is time that the power industry set itself right with the trade of which it has become a part. And it is also time that such differences in point of view and policy should be reconciled between conflicting interests within the industry by frank conference and co-operation without recourse to courts or commissions.

* * * *

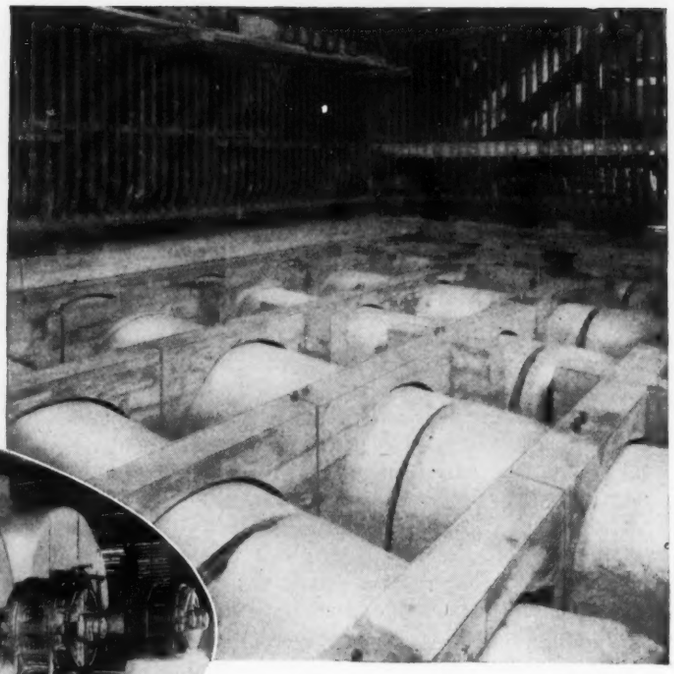
What About Per Capita Data?

UNITS of analytical value in studying electrical operations vary considerably. In a sense, each represents a different angle of approach. Per customer data, revenue per kilowatt-hour, earnings per mile of street served, demand costs per kilowatt and operations per capita all have their place in the armory of the militant statistician. Of late interest has quickened in the accuracy of unit performance figures as gages of true service conditions. The selection of the right statistical tools is most important, and in this connection keen executives have subjected some of these units to a highly critical and valuable cross-fire. Per capita data occupy an exposed position on the company front at the present stage of the campaign to strengthen managerial methods and deserve consideration in view of evident tendencies to employ them rather heedlessly on some occasions. They are valuable, but must be accurate.

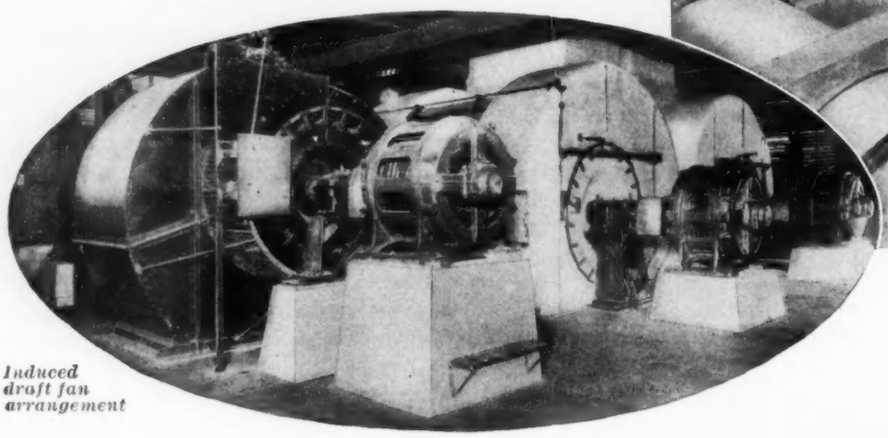
Consistent figures on population are fundamental to any real interpretation of operations on the per capita basis. The Federal Census Bureau strives to realize great thoroughness in every phase of its work, and the value of its findings is acknowledged with pleasure. There is a tendency in the industry, however, to employ these data without due regard to their time significance. That is, we are inclined in some cases to use particular census totals too long as unmodified divisors, and when this is done in territory undergoing rapid development or in areas subject to decided shifts in population density, the result may be out of line with the truth. In this connection it is dangerous to draw conclusions as to comparative development of electrical service in different communities unless the sources of population divisors are strictly defined, dated and actual counts differentiated from mere estimates.

The industrial composition of a community greatly affects the density of its electrical energy consumption, as does the social make-up of residential districts. In order to draw even preliminary conclusions about the electrical usage factor of a given territory, the circumscribing conditions must be well defined and accurately stated. The subject is complex but offers attraction to commercial engineering research. Residential communities can in many places be classified into comparable groups and commercial and industrial operations properly separated in statistical analysis. One approaches the reliable customer-class analysis method as this separation takes place. It may work out in time that the computation of per capita data will be found to be worth while merely as a rough approximation of community usage and expenditures for electrical service and that the study of customers by classes will maintain its precedence.

In and Around the Boilers at Oakland Station

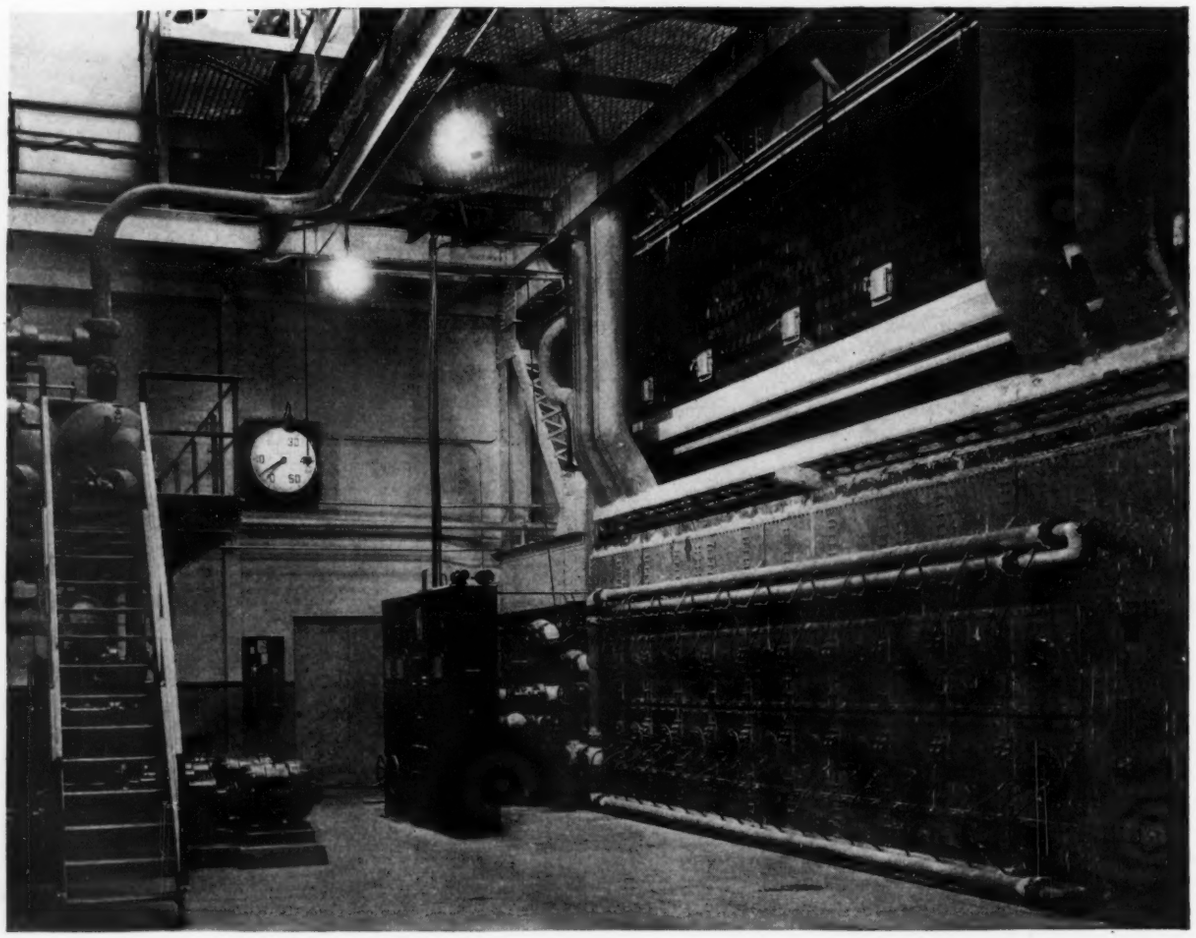


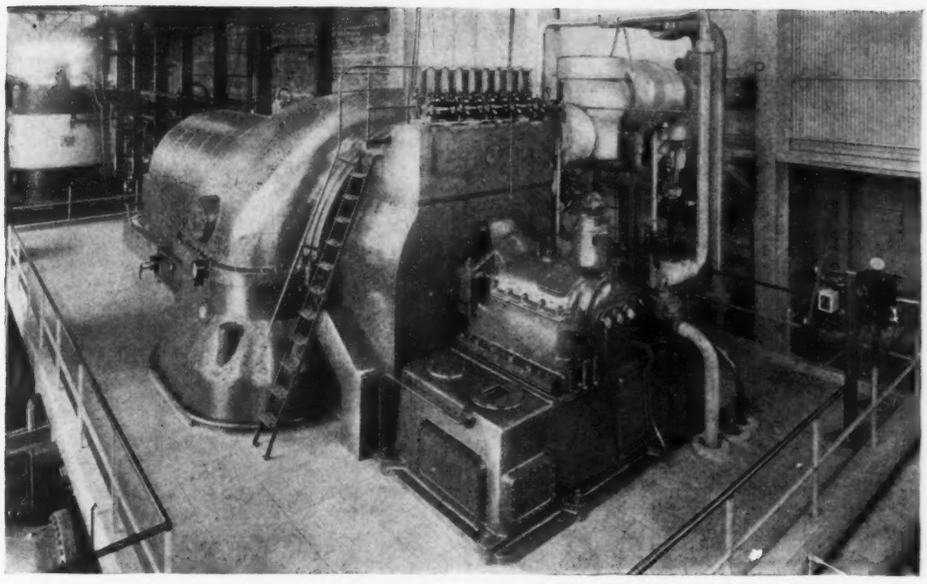
Circular steel ducts beneath furnace floor for conducting heated combustion air to furnace front. Furnace water walls are shown under construction



Induced draft fan arrangement

One of the 35,453-sq.ft. boiler fronts showing oil burners, central control board and load indicator





Nine-stage 37,500-kw. turbo-generator in Oakland steam plant

High Economy Shown by

37,500-Kw. Nine-Stage Turbine

Semi-standby service required that good efficiency be maintained at low loads. Performance of unit installed compares favorably with seventeen-stage turbines

By C. E. STEINBECK
Assistant Engineer Pacific Gas & Electric Company, San Francisco, Calif.

THE 37,500-kw. nine-stage steam turbo-generator placed in operation during the late fall of 1928 at the station C Oakland steam plant of the Pacific Gas & Electric Company has shown remarkable performance for a turbine of such few stages. The unit is driven by a 50,000-hp. impulse turbine. Loads as high as 43,750 kw. have been carried and on many days total generation has exceeded 1,000,000 kw.-hr. Operation of the turbine has been satisfactory in every respect and has more than fulfilled all expectations. It was anticipated that the performance of the unit at maximum load would be at the rate of 440 kw.-hr. per barrel of oil, but actual performance has shown an economy of 465 kw.-hr. per barrel of oil, or 13,300 B.t.u. per kilowatt-hour, gross.

The following extract from a paper by R. C. Powell of the Pacific Gas & Electric Company gives very clearly the reason for the selection of a nine-stage machine:

"The plant operates over a wide range of load conditions; at certain seasons it floats with minimum load as standby to the hydro transmission system; at other times during dry seasons it operates for considerable periods at full load. The desire to obtain a turbine of largest capacity for the space available and which would have good efficiency at light loads led to the selection of a nine-stage impulse turbine. The usual impulse turbine for an output of 42,000 kw. contains seventeen or more stages and the reaction type from 24 to 50 rows of blades, so it is seen that the unit selected is quite a departure from established practice.

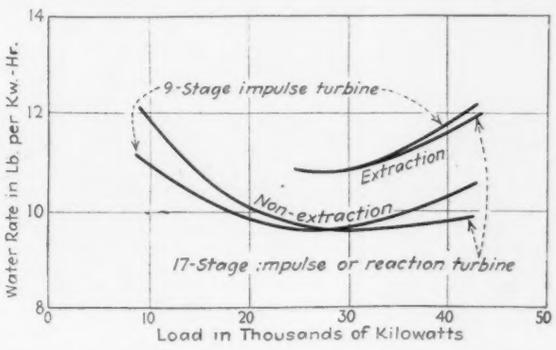


Fig. 1—Water rates of nine and seventeen-stage impulse turbines

"It is believed to be by far the largest nine-stage unit ever built. As is well known, the rating of a turbine is more or less arbitrary and when built to a given frame is rated according to the efficiency desired. When built to a small frame the no-load steam will be less than for a larger frame and up to a certain load will be more efficient. Beyond this load its efficiency will be less. For

the station "C" unit this dividing point is at about 30,000 kw.; up to this point it is more efficient than the conventional unit, but less efficient at higher loads. Taking the water rates on a non-extraction basis, the nine-stage unit does not seem to be altogether acceptable, but it will be seen that extraction for feed-water heating helps very

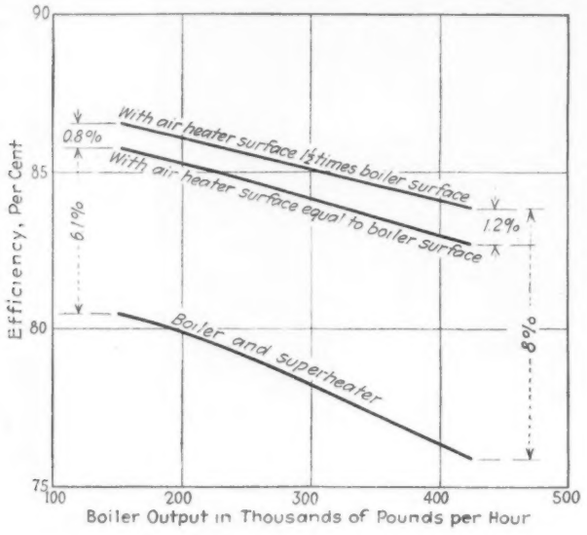


Fig. 2—Effect of air heater surface on boiler efficiency

nicely over the obstacle of apparently low efficiency at full load. The maximum output finally gets down to the amount of steam that can be passed through the last wheel and the efficiency is reduced by the excessive exit loss. Furthermore, the flow capacity of the last wheel does not permit the first few stages to be operated at full peripheral flow. Hence, by extracting rather heavily at the higher stages, the flow through the last wheel is reduced, thereby improving the efficiency as well as increasing the capacity.

"The curves in Fig. 1 show the water rates for the nine-stage station C turbine in comparison with those for the usual type, for both non-extraction and extraction, with four heaters. The use of four heaters raises the temperature of the feed water to 370 deg. and brings the efficiency of the nine-stage unit to within about 1 per cent of that of the ordinary unit. About $1.50 per kilowatt was saved in building foundation and turbine cost by this development."

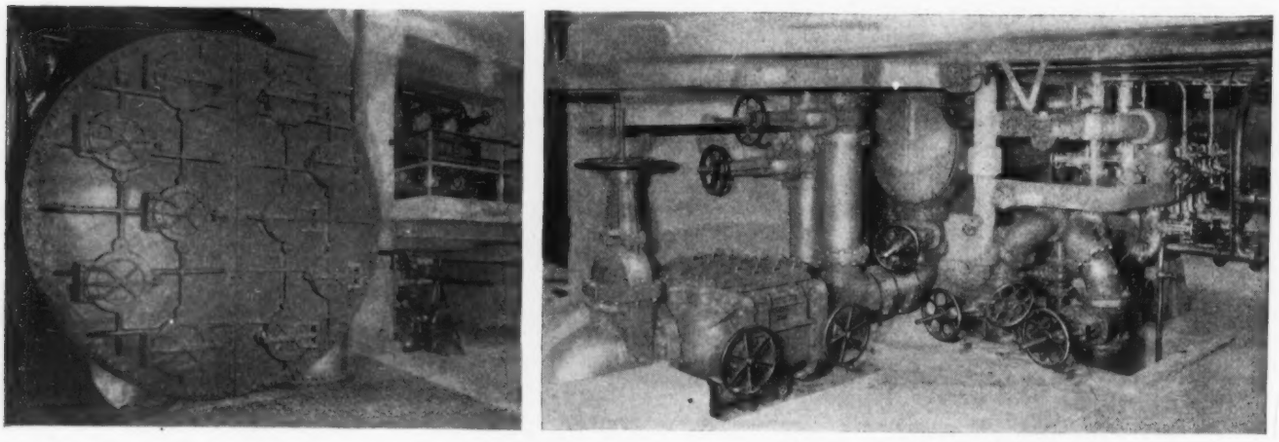
The steam conditions for which the turbine guarantees are given are 425 lb. gage pressure and 700 deg. F. total temperature. The turbine, however, was specified to be designed for 750 deg. temperature, which is reached under certain operating conditions. A load-limiting device which may be operated either by hand or by remote control is provided to prevent the turbine from exceeding some predetermined load. A "Selsyn" indicator is being installed on this device. Also there is a bypass added to the valve mechanism so that there will always be sufficient steam admitted to the turbine when it is floating on the line as a condenser.

The condenser has a surface of 28,000 sq.ft. with a separate air cooler of 2,000 sq.ft. The condenser is of the single-pass, divided water-box type, requiring 60,000 gal. of water per minute. This apparatus as arranged has proved very efficient. With a load of 42,750 kw. on the turbine and 54 deg. F. inlet circulating water the condenser has developed a vacuum of 29.05 in. of mercury when the barometer was 30.04 in. A motor-driven vacuum pump has been ordered to connect in parallel with the steam jet air pumps.

The condensate pumps are driven by variable speed motors controlled by floats connected to the condenser hotwell. As the water rises in the hotwell the float operates a control switch which speeds up the motor and automatically handles any variation in load on the turbine. A "Selsyn" indicator is provided on this switch at the operating engineer's desk. Hand control for these switches also is provided.

All bleeder lines are supplied with reverse current valves which operate by reversal of flow of the steam in the bleeder lines, or should a tube fail in a heater a float-operated pilot valve connected to each heater causes the reverse current valve to close by hydraulic pressure through a cylinder with which each reverse current valve is equipped. The pilot valve also acts to operate a spill-valve attached to each heater.

Two boilers of the cross-drum type were installed in connection with the turbine, each containing 35,453 sq.ft. of boiler heating surface and having a maximum capacity of 425,000 lb. of steam per hour, one boiler being large enough to furnish steam for 37,500 kw. load on the turbine. These boilers are the largest of their type in operation at the present time. Each boiler is equipped with an air heater having a surface of approximately 1½ times the boiler heating surface. The curves in Fig. 2 show the anticipated boiler performance.



28,000-sq.ft., single-pass, divided water-box condenser for 37,500-kw. turbine and strainer, condenser air cooler and steam-jet pumps

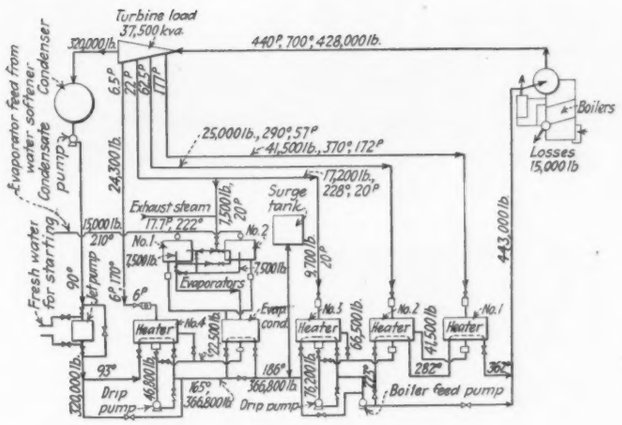


Fig. 3—Heat-balance diagram for 37,500-kw. unit

The heated air for combustion, after leaving the air heaters, is conducted to the furnace fronts by means of circular insulated metallic ducts placed beneath the furnace floor as shown by one of the accompanying illustrations. This form of duct and method of construction have proved very satisfactory. Steel plates are set on top of the piers shown in the illustration and serve as supports for the furnace floor. Sufficient air is allowed to circulate under the steel plates to keep them cool. The illustration also shows the furnace water walls under construction.

With such a large boiler operating at maximum load there is a large drop in pressure through the superheater and in order to allow a higher pressure setting on the superheater safety valves a power control valve, operated by the boiler drum pressure, is placed on each superheater outlet. These valves have proved quite satisfactory.

There is one forced and one induced draft fan for each boiler. Each fan is driven by two constant-speed motors, one small motor for operation at the lower ratings at low speed and a larger motor which operates the fan at higher speed for the higher ratings. Variation in the quantity of air required is controlled by vanes on the fan inlets. The operation of motors and vanes is controlled either automatically by the combustion control system or by push-button control by the fireman from the boiler room floor. Should the induced draft fans for any reason develop a pressure in excess of 5 in. of water in the furnace a Mercoid switch, attached to a draft gage connected to the furnace, trips off the induced draft fan and at the same time also trips a solenoid valve in the fuel oil supply line. This is done to protect the furnace walls from excessive pressure and to keep oil from entering the furnace when the induced draft fans are out of service.

Another safety device attached to the induced draft fans is a speed switch which trips out the solenoid-operated valve on the fuel oil line should the induced draft fans drop below a certain speed. One of the accompanying illustrations shows a view of the fan arrangement and another shows a view of one boiler front and the arrangement of the fuel oil heaters and pumps.

Mechanical type fuel oil burners are used for these boilers. Control of the fuel is obtained by the regulation of two valves, one on the inlet side of the burners and the other on the outlet side. For the higher ratings the outlet valve remains closed and all regulation is done by the inlet valve, while at lower ratings operation of the bypass valve allows for the necessary regulation. The bypass oil is pumped back into the supply line between the inlet-regulating valve and the burners. The fuel may be controlled either automatically or by push button. A "Selsyn" operated load indicator may be seen in one of the illustrations.

The generator operates at 1,800 r.p.m. and is rated at 37,500 kva. at unity power factor. Excitation is at 250 volts, furnished by a 140-kw. direct-current shaft-driven exciter. Standby for this exciter is provided by a separate motor-driven exciter. The generator is cooled by closed systems of air circulation requiring 85,000 cu.ft. of air per minute. Salt water is used for cooling and is obtained by piping the air coolers in parallel with the main condenser circulating water system without the use of a pump on the air cooling system. A strainer is provided on this cooler line to remove any growth which might fall off the piping between the pumps and the coolers, the pumps being at a considerable distance from the turbine. The air cooler and condenser are shown in an accompanying illustration. The strainer mentioned, the condenser air cooler and the steam jet air pumps also are shown.

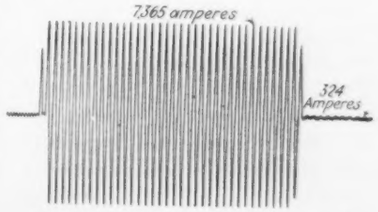
A.-C. Network Investigation

Cable failure check on feeder to system indicates satisfactory operation of network devices and short duration of voltage disturbances

By John Oram

Chief Engineer Dallas Power & Light Company, Dallas, Tex.

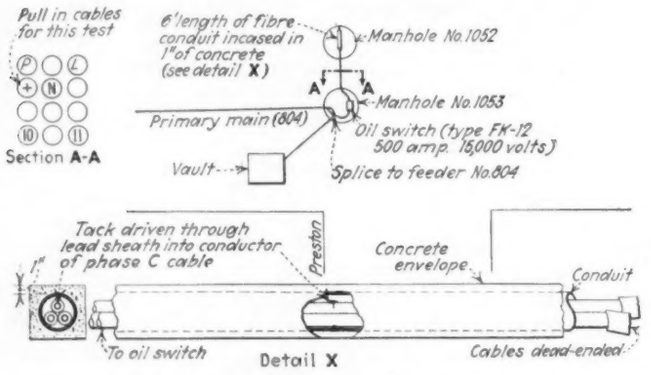
VOLTAGE drop of 19 per cent existed for less than two-thirds of a second on the underground alternating-current network of the Dallas Power & Light Company following the hammering of a large tack into one of the feeders of the system. This investigation was made to determine the behavior of the network under known observed conditions. The test was made on one of the five three-phase, 60-cycle, 13,200-volt feeder cables. These five feeders connect to a bus at the generating station through oil circuit breakers equipped with type CO over-current relays and feed 76 transformer banks. Each of these transformer banks consists of three single-phase, 100-kva. transformers connected star with a grounded neutral supplying a four-wire, 115/199-volt lighting network and a three-wire, 230-volt power network. Each transformer bank is connected to the secondary networks through automatic network units. At the time the failure was placed on the cable one 25,000-kva. generator was in service and in addition the system was interconnected with a second system through a 9,000-kva., 13,200/60,000-volt, three-phase transformer.



Oscillogram of short-circuit conditions during test on underground network feeder

The feeder on which the fault was placed consists of one three-conductor 400,000-circ.mil, 17,000-volt cable, 5,995 ft. in length extending from the generating station to a feeder center. Branching out from the feeder center are primary mains composed of three single-con-

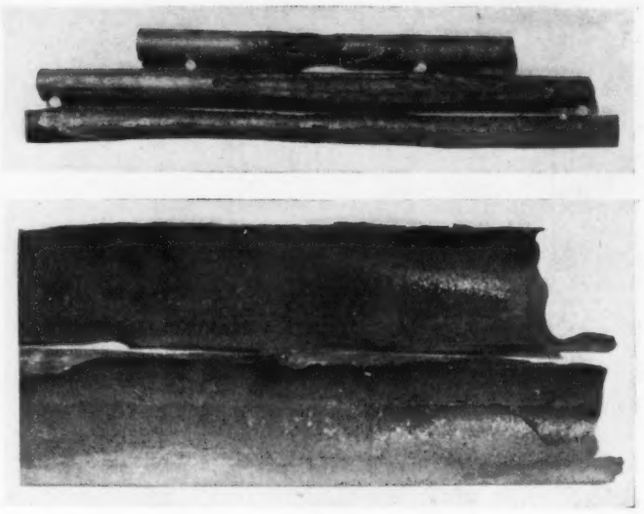
ductor, 250,000-circ.mil, 11,500-volt cables installed in the same conduit. The system has a common primary and secondary neutral, which is a 500,000-circ.mil bare cable installed in a conduit to itself and solidly grounded at each transformer bank. This neutral is connected to the neutral of the generators and the generator neutrals are also solidly grounded. The branch main on which the fault was placed was 1,870 ft. in length. An oil circuit breaker was connected to the end of this branch with 250,000-circ.-mil cables, and with the oil circuit breaker remaining open the mains were extended to a nearby manhole with three short lengths of single-conductor, 250,000-circ.-mil, 11,500-volt cables. A short length of 4-in. fiber conduit that had previously been incased in concrete was placed in this manhole and after a large tack had been driven into phase *C* cable the three cables were drawn into the conduit until the tack was at about the midpoint of this conduit and the cables extended beyond the conduit a sufficient distance to allow dead-end splices to be made on each. A current transformer was placed around phase *C* cable near the oil circuit breaker and the leads extended from the transformer to the street surface, where a single element oscillograph with a film attachment was located.



Set-up for short-circuit test

For observing the test a man was placed at each transformer bank that was energized from the feeder on which the fault was to be placed. The oil circuit breaker was then manually closed and an oscillogram taken of the current flowing to the fault. The result indicates that the tack was consumed in one-half cycle, that the fault was cleared for one-half cycle and at the end of that time the fault again developed and continued for 37.5 cycles with a current of 7,365 amp. flowing. The oil circuit breaker at the generating station then opened and the current decreased in 324 amp. This current continued to flow until all the automatic network units on this feeder had opened due to the reverse power flowing through them, which was approximately five seconds. The rather long interval required to clear the feeder was caused by defective operation of one of the network units, since a protective resistor in the main closing solenoid circuit burned out before the unit opened.

On the other feeders thirteen automatic network units, located near network units on the feeder on which the fault was placed, opened and closed during the test. Since the fault was from phase *C* to ground the potential on phases *A* and *B* at the transformers on the feeder on which the fault was placed was increased above normal, causing a flow of power from these transformers through transformers on corresponding phases located near by on other feeders. This condition produced reverse torque in two of the single-phase relays in each of the



Two-in-one cables and conduit after short circuit

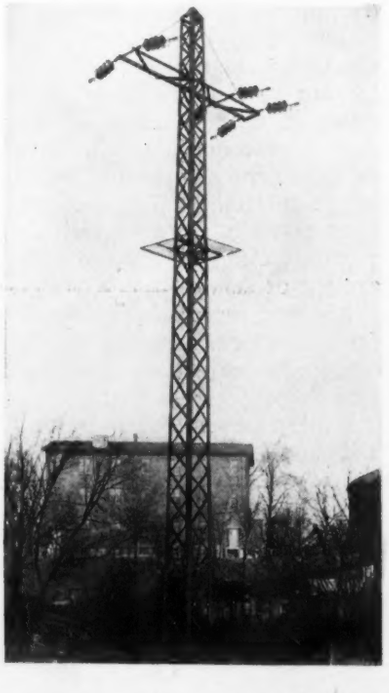
thirteen network units mentioned, with resulting false operation as noted. Such operation would not take place in network units of latest design using polyphase relays.

An examination of the cable and conduit at the fault showed that the lead sheath and paper insulation on phase *C* was entirely burned through and that the 250,000-circ.mil cable conductor was nearly burned in two. The lead was burned from the two other cables and the paper insulation approximately one-half burned through. The fiber conduit was only slightly damaged, it being blistered in the immediate vicinity of the fault. It was observed that during the time the arc endured the manhole in which the fault was located was entirely filled with flame. The only noticeable effect on the operation of the rest of the network system was a drop of 10 per cent in voltage during the 37.5 cycles before the generating station oil circuit breaker had opened.

To Keep Them Down

A LATTICE pole, more than any other, is a powerful temptation to the altitude urge of the small boy. To discourage him before he has climbed high enough to interrupt service, and also to prevent a depressing effect on insurance mortality tables, the Dayton Power & Light Company puts horizontal screen guards on this type of pole.

The protective guard has a hinged trap-door through it which is padlocked so that no one can climb higher unless he has the key.



Open Delta for Permanent Use

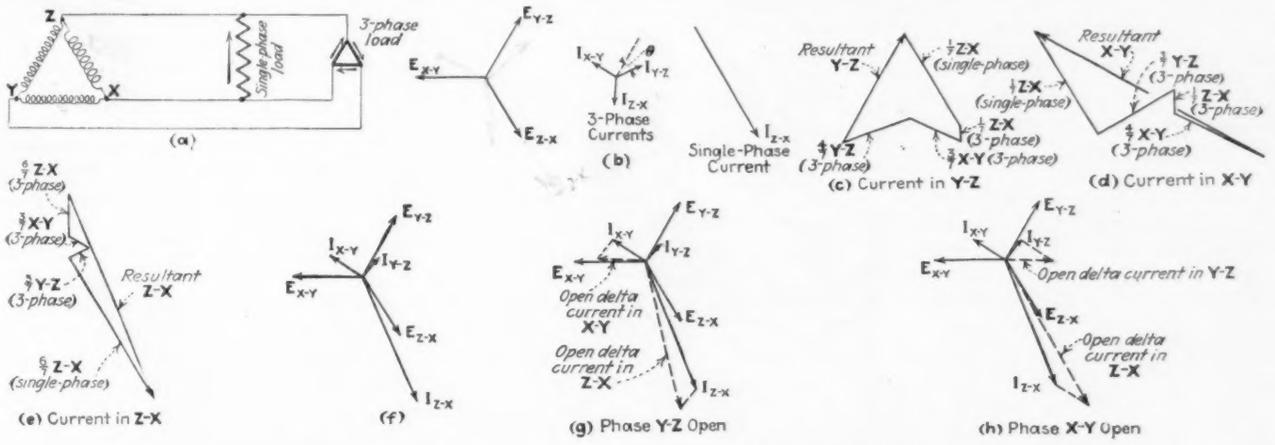
Combined single and three-phase loads are frequently best and most economically served from open, rather than closed, delta transformer banks

By H. P. SEELYE
Detroit Edison Company, Detroit, Mich.

OPEN delta has long been recognized as a practical and, under certain conditions, an advantageous type of transformer connection for serving three-phase loads. For the condition of balanced three-phase power, the characteristics of the open-delta connection are generally well understood. The condition of constant angular separation of current and voltage in the two transformers and the fact that the third phase carries no load result in an unbalance in voltage which under certain circumstances may become a serious disadvantage. This has led to the open delta being usually considered as only an expedient, very useful in some cases in spite of its disadvantages but not generally as desirable as the closed delta for a permanent installation.

If a certain amount of single-phase load is added to the balanced three-phase, however, the current-voltage relations in the transformers are considerably altered. If the single-phase load is large enough compared with the three-phase (equal to it in kilovolt-amperes or greater) and it is added to the proper phase, this effect is sufficient not only to overcome the disadvantages of the open delta but to cause it to show a marked advantage over the closed delta for such a load. It is the intention of this article to point out the nature and relative importance of the open delta characteristic as warranting a more general use of the connection for this quite commonly encountered type of load.

If a single-phase load is connected across one phase of a three-phase, delta-connected bank of transformers the current in passing through the transformers will divide, part going through the transformer directly on the load and part through the other two in series. The division will be approximately in inverse proportion to the impedance of the two paths, i.e., if all three transformers are of the same size and characteristics, two-thirds of the total current will pass through the first transformer and one-third through the others; the total capacity of the bank for such load therefore being 1½ times the capacity of the transformer on the load. If this one were three times as large as each of the others, the latter being equal, and all having similar characteristics, the division would be 6/7 through the one and 1/7



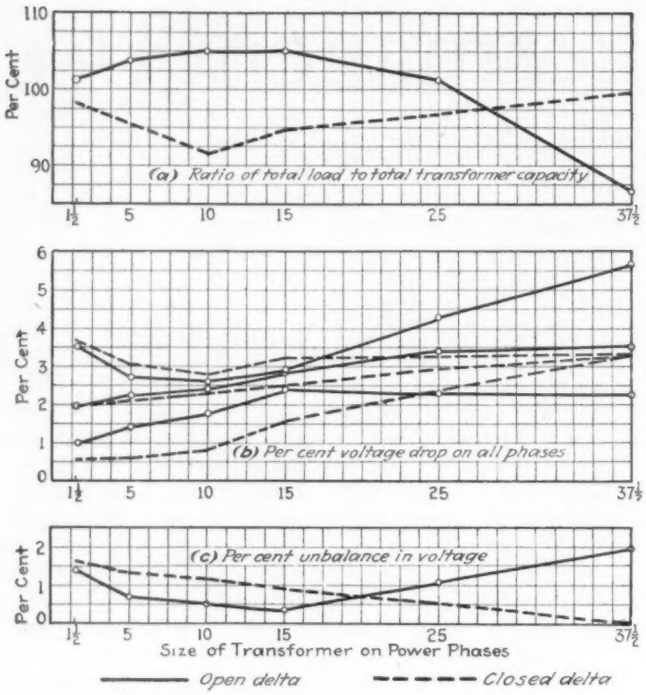
Current and voltage relationship in closed and open delta banks

Combined three-phase and single-phase loads assumed as a basis. In (b) are shown representations of the delta voltages and component currents. In (c) the determination of the resultant current in *Y-Z* is shown. Assuming transformer *Z-X* is three times as large as the others and all have the same per cent *R* and *X*, the load current across *ZX* divides in 6/7 and 1/7 parts, that across *XY* and *YZ* in 4/7 and 3/7 parts. Hence the current in transformer *YZ* is that resulting from the addition of 4/7 the *Y-Z* three-phase load current, 3/7 the *X-Y* three-phase load current (reversed in phase), 1/7 the *Z-X* three-phase load current (reversed in phase), 1/7 the *Z-X* single-phase load current (reversed in phase).

Similarly the currents in *X-Y* and *Z-X* are obtained as shown in (d) and (e). In (f) the relation of these resultant currents to each other and to the voltages is given.

Using the same currents, the effect of removing the underloaded transformer (*Y-Z*) from the bank, leaving transformers *XY* and *ZX* in open delta, is indicated in diagrams (g) and (h). The current formerly carried by *Y-Z* must now pass through the other two transformers (in reverse phase). Adding this current to the currents already in these transformers determines the resulting open delta currents as shown. It will be seen that the *Y-Z* current is at a wide phase angle to the closed delta current in *X-Y*, hence the sum of the two is not a great deal larger than the former *X-Y* current. That is, the transformer capacity necessary in that phase for open delta is not much larger than that already used for closed delta.

In diagram (h) the effect of removing the other smaller transformer (*X-Y*) is shown. In this case the effect of removing *Y-Z* is reversed to a large extent. The resulting power factor in *Y-Z* is much lower than before in either *X-Y* or *Y-Z* and the current in *Z-X* is materially increased, with only a comparatively small improvement in power factor. This demonstrates a very important factor in the use of open delta. In order to gain the advantages possible, *the proper phase must be chosen for the open phase.* In the figures the phase sequence was assumed to be *X-Y-Z* with counter-clockwise rotation of vectors. Hence the proper connection for the single-phase load is *X-Z*, or from the common phase to the phase which leads it by 120 deg.; the smaller transformer should be connected *X-Y*, or from the common phase to the phase which lags it by 120 deg.; the other phase is left open.



Comparative aspects of closed and open delta connections with combined load

Three phase at 80 per cent power factor and single phase at unity. Various sizes of transformers on power phases and 37½ kva. on lighting phase.

through the two. If the three transformers have dissimilar characteristics in regard to resistance and reactance the division is not so simply computed, but may be determined by the use of the usual equations for two impedances in parallel.

In order to analyze the division of a balanced three-phase load or a combined three-phase, single-phase load among dissimilar (as to size or characteristics or both) transformers connected in delta, it is convenient to work with delta load currents rather than with line currents. That is, balanced three-phase load is divided into three equal parts, one connected across each phase, and the single-phase load across one phase is considered separately. The division of each of these components among the three transformers is determined separately by the method given above and the total current in any transformer obtained by adding together (vectorially) all the component currents passing through it. (See vector analysis.)

It is evident from the vector analysis that the load on one of the transformers (Y-Z) is less than on either of the others. This is a characteristic of the closed delta under combined three-phase single-phase loading. Except in the unusual case in which both three-phase and single-phase loads are at unity power factor and all three transformers have similar characteristics, the closed delta will always have one of the smaller transformers with less load than the other. This means unused transformer capacity, since the capacity of the bank is reached with the larger (Z-X) transformer and one of the smaller ones (X-Y) fully loaded.

The closed delta current in X-Y was at a relatively poor power factor. The addition to it of the Y-Z current materially improves the power factor, bringing it fairly close to unity. In Z-X, while the result of the addition of the Y-Z current is a decrease in power factor, that current is relatively small compared with the current already in Z-X, which is at a high power factor on account of the large component of the high power factor single-phase load which it includes. The resulting current in Z-X is still at a comparatively high power factor. Here also the resultant of the two components is much less than their arithmetical sum, being not a great deal larger than the closed delta current in that phase.

The results thus indicated for one particular condition will, of course, be varied somewhat by different conditions of load, power factor, transformer sizes and characteristics, etc., but in general for most cases of loads of this kind ordinarily encountered, these relationships are typical, as will be shown later in various numerical examples. It is evident from diagram (g) that by removing the underloaded transformer from the bank its load is assumed by the two other transformers without necessitating a proportional increase in transformer capacity and with a decided improvement in power factor in the smaller transformer. As expected, this would result in better economy in the use of transformer capacity and reduction in voltage unbalance as indicated by diagram (h).

Numerical Examples

The mathematical analysis of the load division on closed delta and open delta transformer banks and voltage regulation on the same can best be carried out by use of complex quantities, referring all voltage and current

Table I—Loads and Voltage Drops on Closed Delta and Open Delta Transformer Banks

The power factor of the single-phase load is assumed as 100 per cent, of the three-phase load 80 per cent. Loads in each case were determined as the maximum total kilovolt-amperes which could be carried without loading any transformer beyond its rated capacity. Voltage unbalance is computed as the maximum deviation of the per cent voltage drop across any phase from the average of the per cent drops across all three phases, which offers a simple method of comparison.

Transformer Size, Kva.	Connection	*Applied Load in Amps. Single-Phase	Three-Phase	Total	Trans. Load in Amps. Z-X	X-Y	Y-Z	Per Cent Load Trans. Cap.	Per Cent Voltage Drop at Full Load Z-X	X-Y	Y-Z	Per Cent Unbalance in Voltage
37½	Closed	161.0	4.02	173.1	163	6.53	1.13	98.3	1.95	3.67	0.61	1.61
1½	Open	161.3	3.76	171.6	163	6.53	0	101.2	1.96	3.55	0.98	1.39
37½	Closed	160.0	12.3	197.0	163	21.7	7.4	95.4	2.13	3.08	0.61	1.32
5	Open	153.5	12.6	191.2	163	21.7	0	103.7	2.21	2.7	1.4	0.69
37½	Closed	161.8	22.3	228.7	163	43.4	18.8	91.6	2.28	2.80	0.79	1.17
10	Open	141.4	25.1	216.6	163	43.4	0	105.0	2.56	2.39	1.74	0.49
37½	Closed	137.7	46.5	277.3	163	65.2	37.9	94.6	2.50	3.20	1.52	0.89
15	Open	126.1	37.7	239.2	163	65.2	0	104.8	2.87	2.39	2.83	0.31
37½	Closed	93.0	91.7	368.0	163	108.6	83.8	96.8	2.92	3.26	2.32	0.51
25	Open	85.6	63.1	274.9	163	108.7	0	101.3	3.35	2.26	4.26	1.03
37½	Closed	0	163.0	489.0	163	163.0	163.0	100.0	3.29	3.29	3.29	0
37½	Open	0	94.0	282.0	163	163.0	0	86.5	3.49	2.21	5.71	1.91

*The applied load refers to delta currents, not line currents. Single-phase load is connected across Z-X.

vectors to the voltage across one phase as a base. These computations are comparatively simple, but rather long and tedious and are not reproduced here. They can be reduced to formulas by which the load on any transformer in a bank, the per cent voltage drop across any phase, the amount of three-phase and single-phase load which will fully load any combination of transformers, etc., may be determined.

The results of computations for a series of typical examples using combinations of a standard 37½-kva. transformer with various other sizes are given in Table I.

Comparisons of the various factors are shown in the accompanying charts.

Open delta shows an advantage over the closed delta when the single-phase load is fairly large in comparison with the three-phase in the following ways:

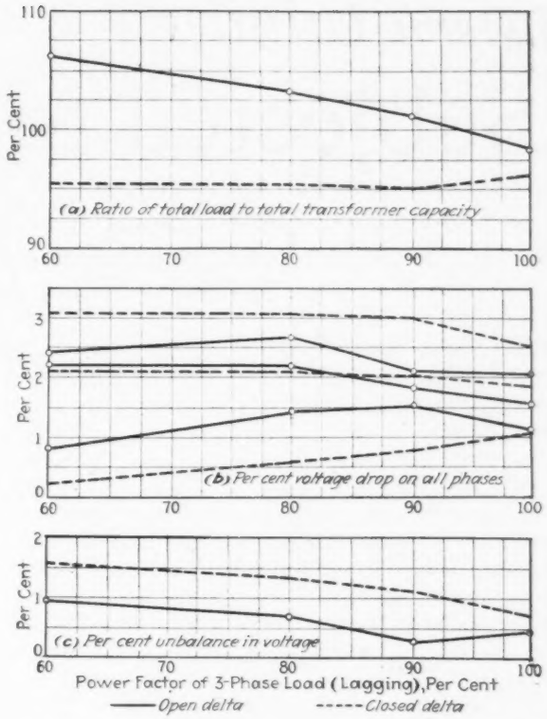
1. A more effective use of transformer capacity; *i.e.*, higher ratio of load to capacity. This ratio is over 100 per cent for all practical cases with open delta.
2. A smaller maximum voltage drop on any of the phases. On the phase across which the single phase is connected the drop is very nearly the same for both connections, but the maximum drop occurs on another phase.
3. A much smaller voltage unbalance; of the order of one-half as much.
4. The advantages hold true for different power factors of three-phase load, being somewhat greater for the lower power factors.

While the numerical results are shown for only a limited number of specific cases and cannot be claimed to represent all cases accurately, it has been found that these advantages apply over a wide range of variations that have been studied. Different sizes and different transformer characteristics naturally alter the results somewhat and also, in practice, the factors of unbalance in primary voltage and unbalance in three-phase motor current due to unbalance in voltage, which have been neglected in this study, have an effect. Sufficient laboratory and field tests have been made, however, to prove the general practical value of the advantages indicated above by the fundamental theory and numerical examples.

Closed vs. Open Delta with Single-Phase or Three-Phase Load Alone.—Since the transformer sizes will be chosen for the combined load, either component alone will be an underload and the voltage drop will be less than that under full load. For three-phase load only, as might be expected, a closed delta bank of a 37½- and two 10-kva. transformers could carry considerably more load than an open delta bank of a 37½- and one 10-kva., or under the same load the closed delta bank would have less voltage drop and voltage unbalance. However, such a comparison is obviously unfair, since the open delta has 20 per cent less total transformer capacity. For the same total capacity properly distributed, the results with one will not be far different from those with the other. It should be noted that an open delta bank consisting of one large and one small transformer will give much better results under three-phase load than one consisting of two small transformers of the same size, since the power factor current is taken by the larger transformer of smaller impedance.

Table II—Voltage Dips on Lighting Phase for Same Load and Same Size of Transformers

Transformers	Connection	Normal Load Current Amperes Single-Phase	Normal Load Current Amperes Three-Phase	Three-Phase Starting Current, Amperes	Voltage Drop on Lighting Phase, Per Cent
37½–5 kva.	Closed △	153.5	12.6	38	1.16
	Open △	153.5	12.6	38	1.24
37½–10 kva.	Closed △	141.4	25.1	75	2.13
	Open △	141.4	25.1	75	2.46
37½–15 kva.	Closed △	126.1	37.7	113	3.07
	Open △	126.1	37.7	113	3.68



Aspects of closed and open delta connections with combined load

Power factor of three-phase load has been used as reference bases. Single-phase power factor is unity. Lighting phase, 37½ kva. transformer and 5 kva. on power phases.

Dips Caused by Motor Starting Currents.—Assuming the same three-phase load for both open and closed delta, with starting current three times the normal load current and at 50 per cent power factor, the voltage drop on the lighting phase (single-phase load) is given in Table II. The dip is somewhat greater with the open delta in these cases. However, here again the comparison is somewhat unfair since the open delta has less total transformer capacity. If the difference in capacity between the two is added to the larger transformer in the open delta, making the total the same in both cases, it will be found that there is less dip with the open delta.

Danger of Burnout if Larger Transformer Fails.—With the closed delta, if the larger transformer fails, the total load is thrown across the two smaller ones in series. Unless these are of nearly the same size as the larger one, they are almost certain to be damaged unless provision is made to clear them by fuses, etc. With the open delta this occurrence is obviously impossible.

In conclusion, a combined three-phase and single-phase load, with the single-phase load equal to or greater than the three-phase, may be served to better advantage with a transformer bank connected in open delta than with one connected in closed delta. The open delta bank gives more efficient use of transformer capacity, less maximum voltage drop on any phase, less voltage unbalance and better protection against burned-out transformers without introducing any material disadvantages. It is believed that its recognition is warranted not only as a temporary expedient or makeshift but also as an efficient and desirable type of installation for not uncommon loads.

Eastern Utilities

Subjected to Ratio Analysis

Present study of a representative group of public utility systems deals with balance sheet ratios. Reflects existing asset and liability position

By Robert Teviot Livingston
Assistant Professor of Mechanical Engineering
Columbia University

PROGRESS is often made by a survey of the financial and operating conditions as they exist in any industry at any time and by a comparison of the conclusions drawn from this survey with the operation of the best companies. In this survey are included 155 operating utilities in the northeastern section of the United States, in the states of New Hampshire, Connecticut, New York, New Jersey and Maryland, for the year 1926. The companies range in size from the largest metropolitan system to smaller companies whose revenues are around $50,000 a year. Of the 155 companies, 42 have revenues of more than $1,000,000 a year. They are distributed as follows: New York, 80; New Hampshire, 26; Connecticut, 23; Maryland, 17; New Jersey, 9.

In the analysis the companies were divided into classes on the basis of how their electricity is produced; 56 purchase power, 43 use water power, 32 use steam and 24 are not differentiated.

Standard Statistical Method Adopted

In the study the standard statistical method of frequency distribution is used and in determining the preferred position the larger companies are given more weight than the smaller, in case of doubt. In many cases companies belong to two different designations, and in this case they are classified on the basis of how the major part of the power was obtained.

This study is not presented as a theoretical analysis of the financial and operating condition of the public utility business in the Eastern states, but rather as a frank exposition of the conditions as they exist. The author draws no conclusions as to the value of the ratios and costs obtained, nor is there any criticism intended in the case of a company which is on the high side of any ratio. Each operating utility is so distinctly an independent problem in itself that one cannot draw general conclusions without knowing all the conditions involved.

In the present article ratios dealing with factors shown in the balance sheet are presented. Such ratios reflect existing assets and liabilities and the relation between specific assets and specific liabilities, which enables one to arrive at some conclusions relative to present worth. The ratios presented are:

I. The ratio of fixed capital plus work in progress plus investments in affiliated companies to the total assets.
II. The ratio of bonds plus stock plus advances from affiliated companies to total liabilities.
III. The ratio in dollars of bonds to the fixed capital plus work in progress.
IV. The ratio of bonds plus stocks plus advances from affiliated companies to the fixed capital plus work in progress plus investments in affiliated companies.
V. The ratio of current assets to fixed capital plus work in progress.
VI. The ratio of current assets to current liabilities.
VII. The ratio of stock to bonds.
VIII. The ratio of preferred stock to total stock.
IX. The ratio of accrued liabilities to total liabilities.
X. The actual book value.
XI. The net worth.
XII. The ratio of retirement reserve to fixed capital.

All these ratios are or have been used to a greater or less extent in analyzing the balance sheet of utilities. The fixed capital ratio shows the proportion of the total assets of a company which are fixed in differentiation to liquid or floating and the bond and stock ratio shows the same for the liability side of the sheet. The ratio of the bonds to the fixed capital is an indication of what is behind the bonds and is of more interest to the investor than to the operator. The fourth ratio, while it is a combination of the first two, is of interest since it shows the relation of the two fixed quantities to each other.

In arriving at an approximate rate base for any company the working capital is sometimes added to the fixed capital. In this survey the current assets are assumed to be identical with the working capital, as the reports of the various public service commissions do not subdivide the balance sheet in sufficient detail to obtain the true working capital. It is therefore of interest to know what is the ratio between the fixed capital and the working capital (or its approximate equivalent, the current assets), even though the commission will not, as a rule, allow working capital to be figured

The study which comprises this and subsequent articles, based on a careful and thorough analysis of a group of utility properties, is meant to give a picture merely of tendencies. Obviously mathematical calculations alone fall short of presenting an adequate measuring rod by which to gage a diverse group of utilities. It is hoped, however, that the results of the study and the methods used may be of interest to those operating engineers and executives who are faced with similar problems to those the solution of which has been here attempted.
Editor.

Balance Sheet Ratios

Ratio	All Companies: Preferred Position	All Companies: Range	All Companies: Number of Cases	Hydro: Preferred Position	Hydro: Range	Hydro: Number of Cases	Steam: Preferred Position	Steam: Range	Steam: Number of Cases	Purchase: Preferred Position	Purchase: Range	Purchase: Number of Cases	Remarks
Fixed capital + work in progress + invest./total assets.	89	82–94	127	88	83–93	31	85	77–93	24	91	79–94	76	Increases slightly with size.
Bonds + stocks + advances from affiliates/total liabilities	78	72–88	124	..	71–89	35	..	63–83	29	80	79–89	75	Size no apparent effect.
$ Bonds/$ fixed capital + working progress	45	30–60	106	60	.....	29	..	.....	18	50	.....	46	Wide spread.
Stocks + bonds + advances from affiliates/fixed capital + etc.	95	85–105	144	105	85–105	43	90	80–100	30	95	70–115	55	.....
Current assets/fixed capital + work in progress	8	5–10	150	7	3–14	29	8	6–17	30	9	6–18	73	.....
Current assets/current liabilities	125	.....	152	100	.....	23	180	.....	30	60	.....	56	Enormous range, figures are very approximate.
Total stocks/bonds	60	–130	98	60	–100	29	60	.....	22	85	60–130	39	Many above values given.
Preferred stock/total stock	68	.....	55	65	60–70	22	45	.....	12	..	.....	14	Few cases, doubtful ratios.
Accrued liabilities/total liabilities	..	0.5–2.3	99	..	.....	..	..	.....	..	..	.....	..	No difference with type of company.
Book value	$120	$100–$160	70	$125	$108–$135	43	$105	$105–$155	23	$135	$108–$145	44	.....
Net worth	$160	.....	59	$160	.....	42	$160	.....	23	$160	.....	43	Many much higher.
Retirement reserve / fixed capital	....	2–12	127	....	.....	..	....	.....	..	....	.....	..	Small companies are high, new and large ones low.

merely as a percentage of the fixed capital. Many people today still judge a company very largely by the relation between the current assets and the current liabilities, and while this ratio has little real significance in the utility business in contrast to an industrial organization, it is here presented. This ratio is designed to show at any instant the ability of a company to meet its immediate obligations without additional financing and without disturbing its capital structure.

In this survey all stock is considered as being of $100 par value; this is done merely in order that the various companies may be compared. Book value is defined as the sum of the surplus and the figure at which the common stock is carried, divided by the number of shares of stock. The net worth is defined as the sum of surplus, reserves and common stock divided by the number of shares of stock. These ratios are indicative of the value of the stock and are useful to the investor as a guide and also of great interest to the management.

In the table above is presented the data classified as previously mentioned. Under each classification is given, first, the preferred position; second, the range of probability, and, third, the number of cases. Where data were not obtained and where no definite conclusions could be drawn the space has been left blank.

The basic data were taken from the reports of the various public service commissions, and where necessary and possible all data were rearranged to conform as nearly as possible with the system prescribed by the public service commission of New York state. No attempt has been made in this survey to evaluate the conclusions drawn nor to explain why the values agree with, or differ from, the accepted figures. In many cases there is such a wide variation in the figures used that a very few companies having similar ratios have determined the preferred position. From a true statistical point of view many of the figures reported are unwarranted because of this reason. However, as this is only a survey, the figures are presented and appropriate notations inform of such conditions.

In the next article of this series the various ratios of the income statement and the ratios between the income statement and the balance sheet will be presented.

Preparation and Control of Improvement Budgets

By E. C. Stone
System Development Manager Duquesne Light Company

THE preparation and control of the improvement budgets for the Duquesne Light Company are under the direction of the system development department, which is responsible for: (1) Producing a satisfactory budget for executive approval each year, and (2) exercising such control as necessary to make sure that the authorized funds are spent as proposed by the approved budgets. This department is similarly responsible for handling the improvement budgets of closely associated companies.

Although the system development department is directly responsible for the preparation of improvement budgets, they represent when completed the combined best judgment of all interested parties.

The successive steps involved in the preparation and approval of an improvement budget are shown graphically.

Calculation of Return

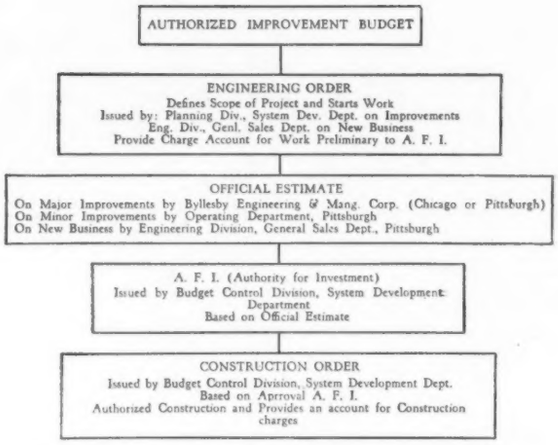
Determination of the money available for return on the additional investment is obviously necessary to maintain a sound financial condition. Estimates of the expected revenue and operating expenses are obtained from the sales and operating departments respectively. The difference represents the gross income from which the return on the investment can be calculated. The increase which this estimate shows over the previous year gives the amount which will be available for return on the additional investment. This amount, plus a renewal and replacement fund that will accrue during the year, gives an approximate total figure for which the budget must be set up.

With a tentative construction program showing the maximum to be included in the budget and the estimated amount of revenue available, a series of conferences of representatives of all interested departments is held under the leadership of the system development department,

where the order of importance of the proposed projects is established. The final budget program includes work agreed upon as of vital importance and requires an expenditure not inconsistent with the increased earning power expected.

There are some expenditures which cannot be concretely determined when the budget is prepared. Chief among these are: (a) Certain renewals and replacements which may be necessary because of unforeseen events and work connected with municipal improvements on which specific information cannot be obtained; (b) new-business connections which are not known until the contract is signed, and (c) operating emergencies.

After using every possible means to reduce all projects to concrete expenditures, it has been found that a certain amount per year is required which cannot be anticipated in detail. Of this amount about 56 per cent is for new-business appropriations, 13 per cent for operating emergencies, 12 per cent for municipal improvements, 7 per cent for distribution and 5 per cent for substations.

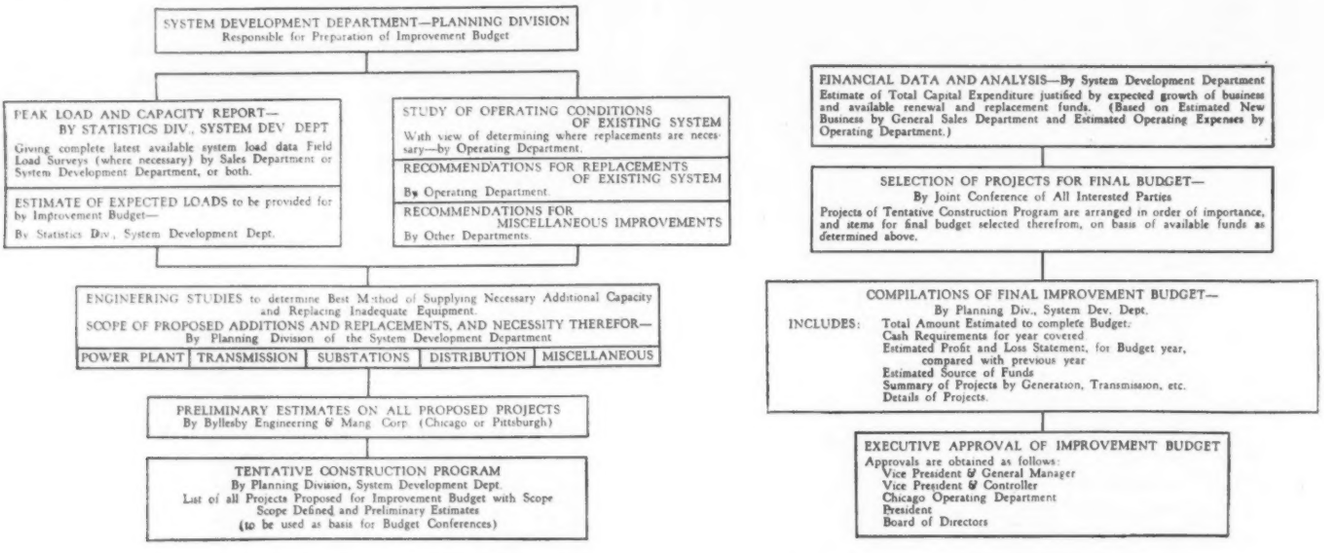

AUTHORIZED IMPROVEMENT BUDGET
ENGINEERING ORDER
Defines Scope of Project and Starts Work
Issued by: Planning Div., System Dev. Dept. on Improvements
Eng. Div., Genl. Sales Dept. on New Business
Provide Charge Account for Work Preliminary to A. F. I.
OFFICIAL ESTIMATE
On Major Improvements by Byllesby Engineering & Mang. Corp. (Chicago or Pittsburgh)
On Minor Improvements by Operating Department, Pittsburgh
On New Business by Engineering Division, General Sales Dept., Pittsburgh
A. F. I. (Authority for Investment)
Issued by Budget Control Division, System Development Department
Based on Official Estimate
CONSTRUCTION ORDER
Issued by Budget Control Division, System Development Dept.
Based on Approval A. F. I.
Authorized Construction and Provides an account for Construction charges

Procedure to be followed in securing authorization of improvement budget projects

Preparation of Final Budget

After all the interested parties have agreed upon the exact make-up of the budget, the planning division of the system development department compiles the final draft for executive approval. This is made up of the following essential parts: (a) Summary of projects and total of budget; (b) estimated cash requirements and estimated rate of return on proposed additions; (c) scope of proposed program; (d) estimated income and fixed capital on completion of budget; (e) source of funds; (f) comparison with previous budgets, and (g) summary, including detailed cost of proposed projects.

The control of authorized improvement budgets involves both financial and physical control. In order to understand the methods used, it is necessary to be acquainted with the routine under which the specific projects are handled. Engineering control is maintained by the issuance of an engineering order which defines the scope and starts the work on each project, and by the checking of the official estimate upon which authority for construction is asked. Financial control is maintained through (a) a budget ledger, in which each specific appropriation is set up and is charged against the proper budget project, so that the exact state of commitments and unassigned funds under each budget is known at all times, and (b) the receiving of field reports from the construction forces showing the relation between estimates and expenditures and the probability of over-run.


SYSTEM DEVELOPMENT DEPARTMENT—PLANNING DIVISION
Responsible for Preparation of Improvement Budget
PEAK LOAD AND CAPACITY REPORT—
BY STATISTICS DIV., SYSTEM DEV DEPT
Giving complete latest available system load data Field Load Surveys (where necessary) by Sales Department or System Development Department, or both.
ESTIMATE OF EXPECTED LOADS to be provided for by Improvement Budget—
By Statistics Div., System Development Dept.
STUDY OF OPERATING CONDITIONS OF EXISTING SYSTEM
With view of determining where replacements are necessary—by Operating Department.
RECOMMENDATIONS FOR REPLACEMENTS OF EXISTING SYSTEM
By Operating Department.
RECOMMENDATIONS FOR MISCELLANEOUS IMPROVEMENTS
By Other Departments.
ENGINEERING STUDIES to determine Best Method of Supplying Necessary Additional Capacity and Replacing Inadequate Equipment.
SCOPE OF PROPOSED ADDITIONS AND REPLACEMENTS, AND NECESSITY THEREFOR—
By Planning Division of the System Development Department
POWER PLANT
TRANSMISSION
SUBSTATIONS
DISTRIBUTION
MISCELLANEOUS
PRELIMINARY ESTIMATES ON ALL PROPOSED PROJECTS
By Byllesby Engineering & Mang. Corp. (Chicago or Pittsburgh)
TENTATIVE CONSTRUCTION PROGRAM
By Planning Division, System Development Dept.
List of all Projects Proposed for Improvement Budget with Scope
Scope Defined and Preliminary Estimates
(to be used as basis for Budget Conferences)
FINANCIAL DATA AND ANALYSIS—By System Development Department
Estimate of Total Capital Expenditure justified by expected growth of business and available renewal and replacement funds. (Based on Estimated New Business by General Sales Department and Estimated Operating Expenses by Operating Department.)
SELECTION OF PROJECTS FOR FINAL BUDGET—
By Joint Conference of All Interested Parties
Projects of Tentative Construction Program are arranged in order of importance, and items for final budget selected therefrom, on basis of available funds as determined above.
COMPILATIONS OF FINAL IMPROVEMENT BUDGET—
By Planning Div., System Dev. Dept.
INCLUDES:
Total Amount Estimated to complete Budget.
Cash Requirements for year covered
Estimated Profit and Loss Statement, for Budget year, compared with previous year
Estimated Source of Funds
Summary of Projects by Generation, Transmission, etc.
Details of Projects.
EXECUTIVE APPROVAL OF IMPROVEMENT BUDGET
Approvals are obtained as follows:
Vice President & General Manager
Vice President & Controller
Chicago Operating Department
President
Board of Directors

Steps 1 and 2 in the preparation of the improvement budget

Peak Load and Capacity Report.—Immediately following each December, during which the highest system peak load of the year usually occurs, the annual peak load and capacity report is compiled from load data obtained in the meters in various stations. The loading and capacity of every essential piece of equipment and every line are given either in graph or tabular form. In the past the loading in districts requiring additions has been so far from saturation that very few load surveys have been required. But in the future it is probable that load surveys will deserve more attention.

Expected Loads.—On the basis of data from the peak load and capacity report, together with available previous load data from which estimated rate of growth may be obtained, and from load surveys where made, estimates are set up showing the loads expected on every piece of apparatus on the system at the time when the budget program will be completed. From the estimated increases in connected load as furnished by the sales department, and the "use factor" determined from analyses of actual loads, developed from connected loads in the past, the system peak load is estimated for various conditions of business activity. In general, it has been found that the actual system peaks have fallen between the values established from eight-year, average-year and maximum-year use factors. It is assumed that future loads will lie between the same limits.

Scope of Projects.—Based on data obtained as mentioned, engineering studies are made to determine the best method of supplying the necessary additional capacity and of replacing equipment.

Preliminary Estimates on Proposed Projects.—A list of all proposed projects with the preliminary scopes thereof is forwarded to headquarters, which prepares estimates on all projects submitted. On completion these are turned back to the planning division of the system development department.

Rural Line Tree Trimming

AFTER some not altogether smooth experience with the rigid policy on rural lines that all trees in the space between vertical lines, 10 ft. on each side of the wires, must be cut and that no branches may overhang or extend into this space, a Middle West utility found some modifications advisable. Where it is possible, without difficulty, the rule is enforced, but in cases where it is impracticable to cut and trim for this clearance, particularly in front of residences and schools and along pasture fields where trees shade stock, and along state highways where the state has jurisdiction of trees on the highway side of the fence, this clearance may be modified, with the approval of the engineering department, as follows:

Where both hardwood and softwood trees are growing, the softwood trees should be cut and hardwood trees which cannot be cut shall be trimmed as described below.

Where it is impracticable to cut all of the softwood trees, those remaining shall be so trimmed, where the tree trunk is not in a direct line with the wires but is off to one side, that the wires do not go through a hole in the tree, but all branches below and at the same level with the wires are cut off and branches which overhang the wires are trimmed to clear by 10 ft., or as nearly 10 ft. as practicable, depending on the diameter of the limbs. In cases where the trunk of the tree is in line with the poles and a V is trimmed in the center of the tree for the wires each side of the V shall be trimmed as just described.

Elm trees and other hardwood trees which branch in similar fashion shall be trimmed as described for softwood trees.

Poles should be arranged to offset the wires from the center of hard maple and evergreen trees. If it is then impracticable to trim as described for softwood trees, the branches shall be trimmed for a specified clearance in every direction from the wires, this clearance to be as great as practicable and to be incorporated in the right-of-way.

No small trees shall be left growing under the line with the exception of fruit trees which will permanently clear the wires with practically no trimming. No small trees of any kind at the side of the line shall be left except with the understanding that they shall be trimmed in the future as described above. In special cases, trees may be left with the understanding that they are to be replaced with other trees set further back and that they are to be cut down after a specified number of years to be stated in the right-of-way.

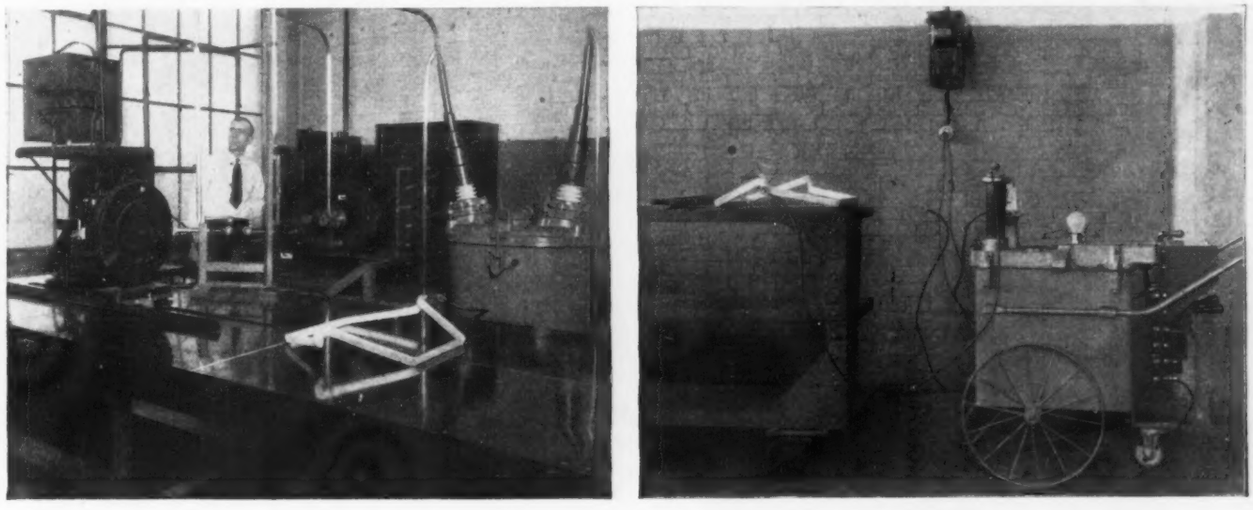
Side arming shall not be used unless absolutely necessary and shall be limited to the standard four-pin crossarm. No use shall be made of six-pin sidearms to clear trees.

In cases where it may be necessary to drop crossarms several feet below tops of poles to clear under trees at residences having service drops crossing the road from telephone leads on the opposite side arrangements may be made with the telephone company for a clearance contact on the top of the pole. If the telephone company objects to placing its service drop over the lead the wires may be insulated by splicing in a suitable length of tree wire.

Preventive Test Indicates Winding Weakness

By A. C. Roe
Westinghouse Electric & Manufacturing Company

THE presence of weak spots in the windings of coils of rotating electric apparatus may be detected with virtual certainty by a new system of high-frequency testing. Weak spots which ordinary testing does not indicate may be determined by the preventive method which the Westinghouse Electric & Manufacturing Company uses for testing all stator coils shipped to repairmen in the field, the renewal coils being tested for internal defects and slot sections being tested for breakdowns to ground.



Defects in windings of coils may be determined by high frequency test

Tests for internal defects are made previous to ground test of slot sections

The high-frequency test consists of sending a high voltage (one-third of the final ground test voltage) to each individual coil so that if the final ground test is 22,000 volts each single coil would have 7,300 volts impressed upon it. A static voltmeter is used up to 3,500 volts and above that the spark gap is used to measure the voltage in effect on the coil.

The current passing through each turn of the coil searches out weak spots and sets up a magnetic field. This field acts as a radio-sending station, to which meters may be tuned in to indicate defects in the coil.

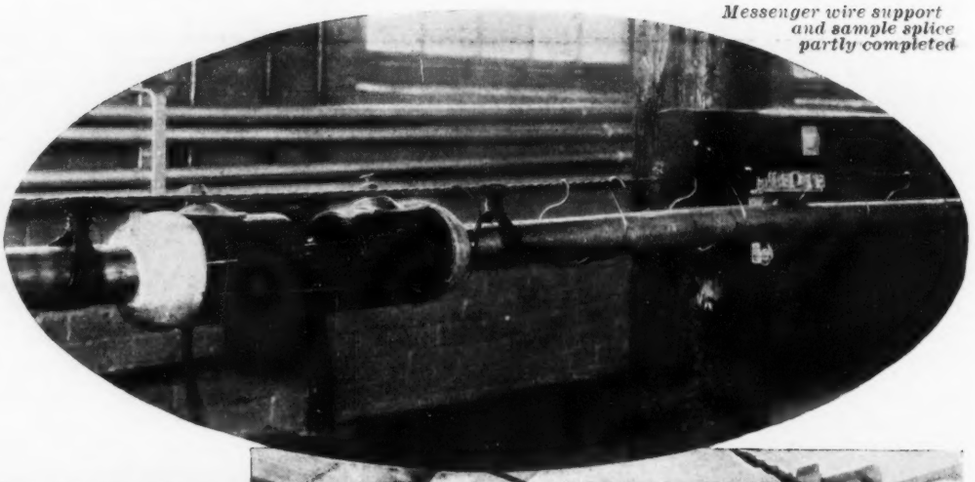
After the high-frequency test each coil side is tested to ground by incasing the block section in metal sheaths extending to within 1 in. of the bend at each end and the test applied.

The value of this preventive test to repairmen means insurance from trouble and is particularly valuable where there are difficult bends in the coil or for high-voltage coils. When the high frequency test is applied before and after insulating, the final test is reduced to 85 per cent of the first test.

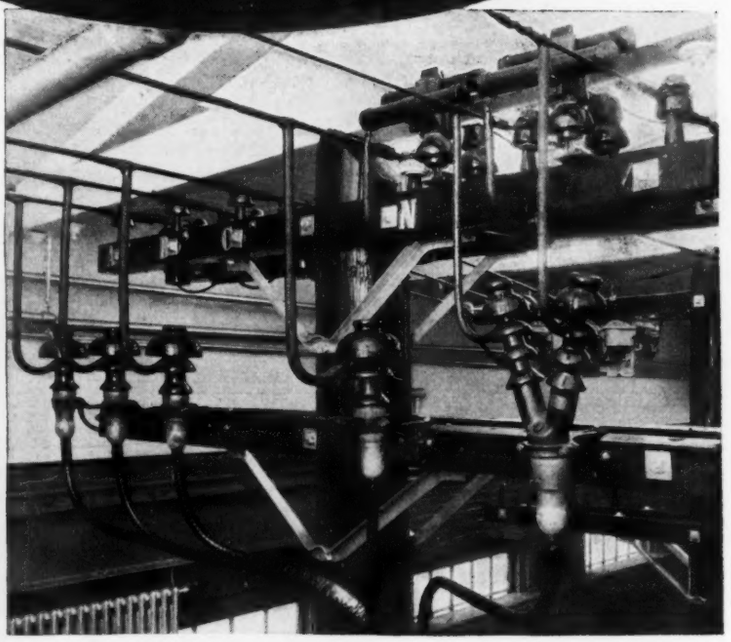
Models of Construction

Used to Instruct Linemen

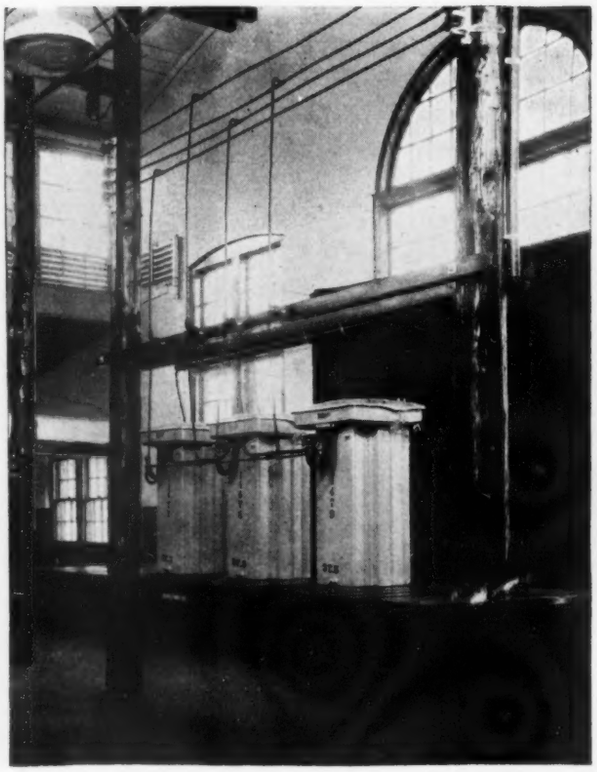
(Westchester Lighting Company)



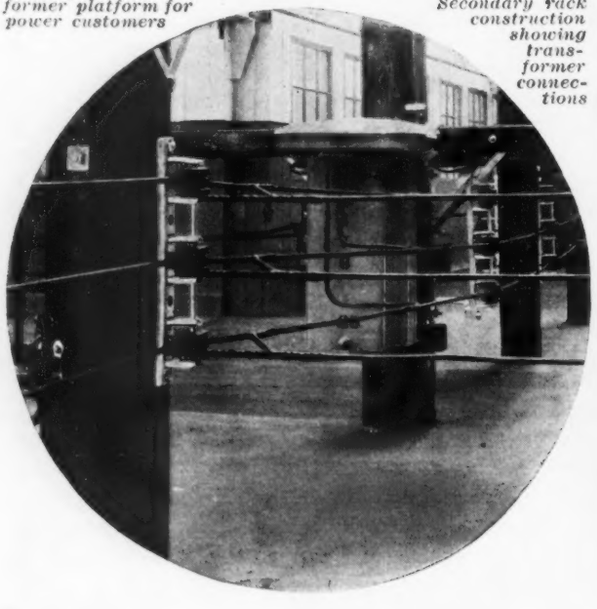
Messenger wire support and sample splice partly completed



Standard arrangement of potheads for underground connections

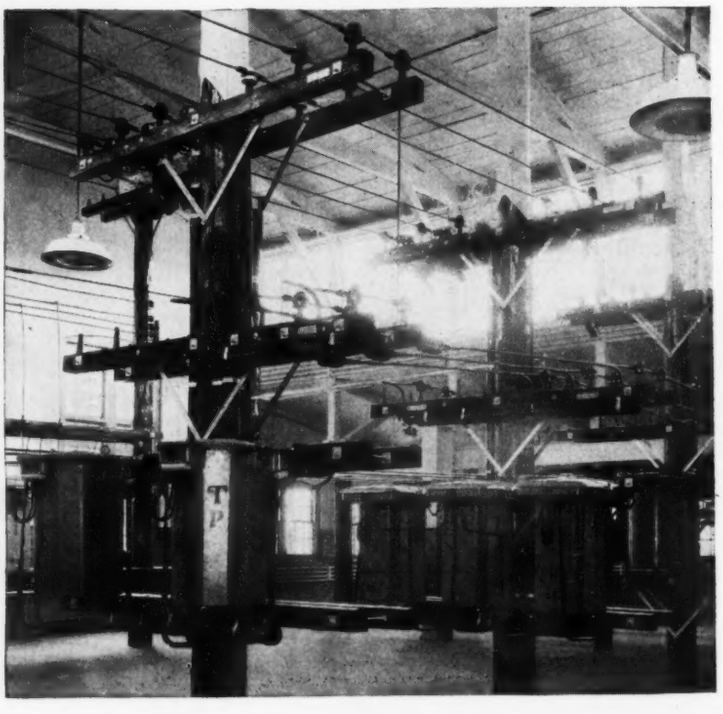


Three-phase transformer platform for power customers



Secondary rack construction showing transformer connections

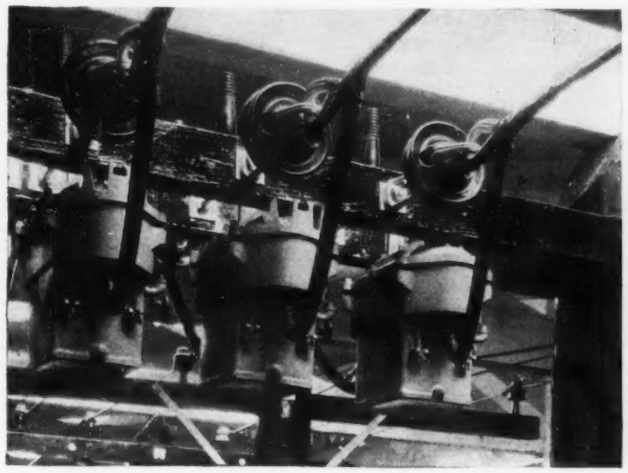
Two- and three-phase transformer connections showing primary leads in fiber ducts



Line-Labor Turnover Reduced by Training Employees

By A. D. Clark
General Superintendent of Lines
Westchester Lighting Company

DUE principally to the employment of so-called "floaters," the labor turnover of linemen employed by the Westchester Lighting Company exceeded 60 per cent per annum at one time. As a corrective measure a linemen's school has been established to train resident labor to do the desired class of work. Aside from aiding in the establishment of a well-chosen, well-trained and stable personnel, this school affords an excellent opportunity for standardizing on methods of safety and of construction, resulting in fewer accidents and better workmanship. The equipment consists of a full-sized model distribution system (see opposite page), complete in every detail as to joints, dead ends, transformers,



Full-sized model of pole type sectionalizing switches

street light brackets, traffic units, primary circuits, series circuits, secondary circuits, services, aërial cable, potheads, guys, etc., together with a display of every type of tool and appliance used in the work, all being contained in a large room and used for demonstrations in connection with lectures. In a nearby yard is a similar model distribution system where students actually perform the climbing work prescribed by the course.

A new employee in the line department enters as a third-grade lineman's helper and works on a gang three months, after which time he is subject to a one-week course of instruction in the school. Aside from the routine subject matter prescribed by the course, lectures on practical application are given by the various superintendents and safety instructions are given by safety directors. The procedure gives the employee an opportunity to first observe the work and then to be instructed in the elementary phases by men of wide experience. Contact with the superintendents tends to arouse the man's enthusiasm and interest.

At the completion of the first grade of the course the man is promoted to a second-grade lineman's helper, if he attains a satisfactory percentage in his class work, and is recommended for promotion by his foreman and superintendent, and so on to higher grades.

The success of the school may be gaged by the fact that the labor turnover gradually decreased from 60 per cent to 47 per cent for the year 1927 and to 21¾ per cent for the year 1928. The average number of employees during 1928 totaled 608. Another outstanding accomplishment, also credited largely to the school, is that 23 per cent more work was done in 1928 than was done in 1927, with an increase of only 2 per cent in personnel.

Electrochemical Industries Increasing

INDUSTRIALISTS producing chemical and metallurgical products and power companies seeking new uses for electricity can hardly afford to overlook the progress of electrochemists and electrometallurgists if they are going to keep abreast with developments. A sketchy picture of the extent to which electricity is being applied in these fields was presented by Dr. Colin G. Fink, secretary of the American Electrochemical Society, before the New York section of the A.I.E.E., recently.

He reported that 1,000,000 tons of electrolytic copper is now being produced per year and that a production of 2,000,000 tons may be expected shortly because of the demand. English, Belgian and African plants are expanding rapidly to utilize the enormous copper resources of the Belgian Congo and Cape Colony. Research in copper refining has permitted reducing the potential drop per cell to 0.18 volt. A higher operating temperature (55-60 deg. C.) and a higher concentration of sulphuric acid (200-250 grams per liter) helped.

Sixty tons of chlorine are being produced electrolytically per day at the Westvaco Chlorine Products Company plant in Charleston, W. Va., using the Vorce unit.

Pure aluminum, which does not corrode and is not attacked by dilute hydrochloric acid, is being made electrically by the Aluminum Company of America at Alvida, on the Saguenay River. Carborundum and alundum are being produced electrically to the extent of 100,000 tons a year in the United States and Canada.

Electrolytic iron pipe has been made at Grenoble, France, for twelve years. It is very pure and homogeneous. Dr. Fink expressed the opinion that he cannot see how other iron pipe can compete with it.

Seven hundred electric steel furnaces are being operated in the United States and Canada, one having the stupendous rating of 60 tons and 20,000 kva. The Soderberg continuous electrode which is formed as required was referred to as a very remarkable development. At present there are 5,000 kw. in Ajax-Northrup high-frequency furnaces melting brass and Dr. Fink prophesied that this type may overtake arc furnaces.

Electrolytically deposited copper and graphite makes excellent oilless bearings, Dr. Fink pointed out. By taking great pains to assure a pure electrolyte, one plant is producing 1,000 tons of electrolytic zinc a day. Berylium (added in small quantities to add strength to steel) is also produced electrically.

A new development of the Eastman Kodak Company having great possibilities is the electrodeposition of rubber. Chromium plating has come into particular prominence where a hard durable finish that can withstand corrosion is needed. While its reflectivity is only 82 per cent of freshly polished silver, it is 130 per cent of silver after the latter is exposed only a short time to tarnishing. Aluminum is now being plated with chromium, thus permitting a light metal to be used where a durable finish is required.

Progress in Electric Brass and Copper Annealing

RAPID progress is being made in the annealing of non-ferrous metals electrically in Connecticut, according to a paper by Jewett F. Schrumn, Waterbury, before the recent industrial electric heating conference at Cambridge, Mass. One industrial plant will shortly have nine electric furnaces in service with a total connected heating load of 1,770 kw. Box type furnaces are mainly used for brass annealing in this establishment, with an inside length of 17 ft., a width of 4.5 ft. and a height of 18 in. to the spring of the arch. One such furnace has been in almost continuous operation ten hours a day for five years at a chamber temperature of 1,260 deg. F. without coil burnout or any other furnace maintenance expense. By the use of selective load control the production of one furnace in annealing yellow brass tubing has been increased from 18.2 to 20 lb. per kilowatt-hour, and still further improvement in control design has brought the output to 24 lb. per kilowatt-hour in the company's latest furnaces. Pickling has been reduced to one-fourth of that previously required. These furnaces anneal brass tubing at a cost of $2 to $2.50 less than wood-fired furnaces and result in a return of about 50 per cent on the furnace investment. Another Connecticut manufacturer reports annealing 30 to 40 lb. of brass per kilowatt-hour in a 150-kw. counterflow recuperative furnace.

A manufacturer of copper tubing for refrigerator and automobile use saves $5 per ton in operating expenses for bright annealing by the substitution of 120-kw. water-seal electric furnaces for gas-fired units. There has been no maintenance cost for four years with the electrics, which operate at 1,300 deg. F. The furnace chambers are 37 in. in diameter by 5 ft. high. The cost of electricity per ton of material treated is several dollars less than the former gas cost and the maintenance saving is striking, since in the gas installation the repair charges ran for some months above the average fuel cost.

Power Requirements of Electric Doughnut Kettles

FOUR 15-kw. doughnut kettles are now in use at the plant of the Cushman Baking Company, Lynn, Mass., which employs electric heat in all its production. The power requirements are given in the accompanying table.

In the latest design of kettle, switches, cutouts and automatic contactors are located at the front in the outer shell. It is estimated that a saving of 27 per cent in grease over the fuel-fired type is realized by electric frying. The installation was made by the Edison Electric Appliance Company, Inc.

Data on Doughnut Kettles

	Doughnuts	Crullers
Size of kettle	24 in. x 34 in.	24 in. x 34 in.
Connected load, kw., each	15	15
Fat capacity, lb.	225	225
Kilowatt-hours to heat to 375 deg. F.	10	10
Time to raise heat from room temperature, min.	40	40
Power required to maintain temperature at 400 deg. F., kw.	2.7	2.7
Weight in ounces per dozen fried	21.75	18
Fat absorption in ounces per dozen	4	2.5
Time in hot fat, minutes	2	3
Number in fat at one time, dozen	5	9.5
Capacity in dozens per hour	125-150	375

Commission Viewpoint on Service

By E. H. MORRIS

*Chief Engineer Board of Railroad Commissioners, State of North Dakota**

"SERVICE" as we of the regulatory bodies see it . . . is an act of supplying some general demand, . . . at reasonable rates and in a manner to satisfy the customer.

Not to exceed 5 per cent of the so-called service problems have any excuse in reaching us for investigation. Of these, another 3 per cent could well be settled by your contact man.

There is no excuse . . . for a complaint regarding accuracy of meter indications to reach us. Settle that complaint within 24 hours of its inception and make the complainant your friend.

You are concerned in getting the maximum revenue possible from your distribution network. You should figure out the most liberal rule possible of application to extensions outside corporate limits and so apply the rule that your prospective consumers will see your viewpoint and its equity, and not come to the regulatory body for a hard and fixed rule.

Some companies insist that the refrigerator is a power appliance, some that it rates the same consideration as a stove, and others that it does not rate anything different from the washing machine and thus goes on lighting schedule. The problem will not long be kept from us if you men do not get together.

Incorrect billing complaints should never reach the regulatory body. Where is your contract man? Wherein did he fall down when he contracted to sell the patron service?

Errors of book-keeping should not creep in . . . why is not the whole matter settled on the spot when the first "howl" arises? It is pure childishness to let a complaint of this kind reach the regulatory body and indicates that something is wrong in administration somewhere.

One of the most important service problems arising before you now concerns radio interference, and you men must attack it on a broadminded basis or you will have stringent legislation passed by state legislatures.

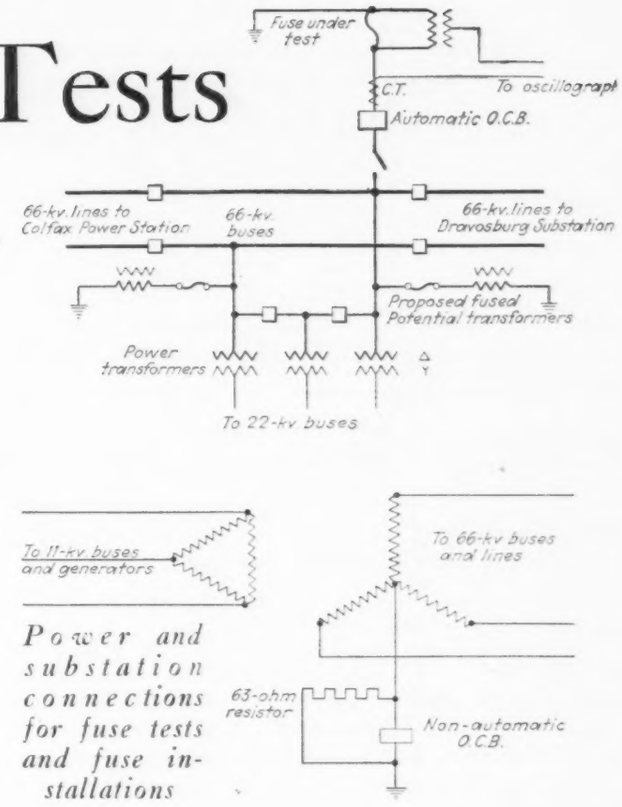
Service problems should be settled by yourselves at their inception and kept away from the regulatory body except as a last resort.

**Excerpts from address to Engineering Conference, North Central Electric Association.*

66-Kv. Fuse Tests

Interrupt 145,000 kva., single phase, on 66-kv. circuit. Used between potential transformers and buses

By B. M. Jones and E. H. Coxe, Jr.
Duquesne Light Company, Pittsburgh, Pa.



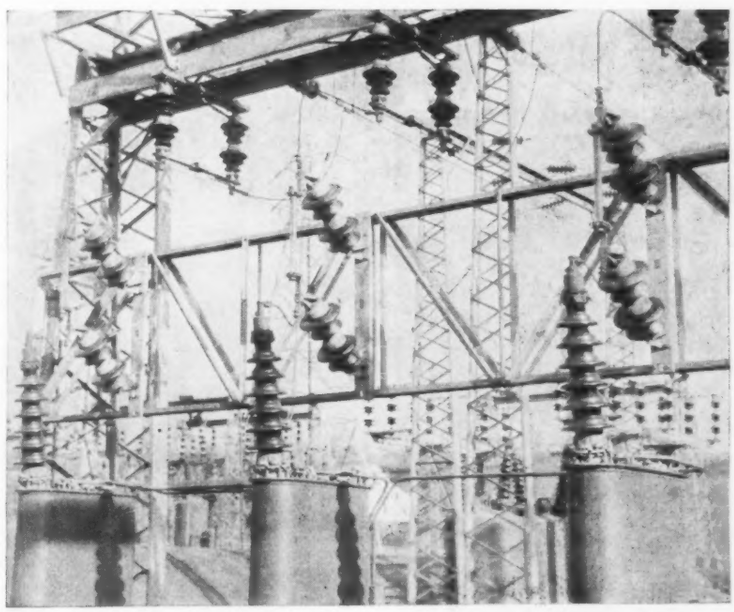
Power and substation connections for fuse tests and fuse installations

UNTIL recently the Duquesne Light Company had obtained potential for the operation of directional relays protecting 66,000-volt lines from potential transformers connected to the 22,000- or 11,000-volt buses in the stations involved, and since there are no stations on the system used for 66-kv. switching alone this was always possible.

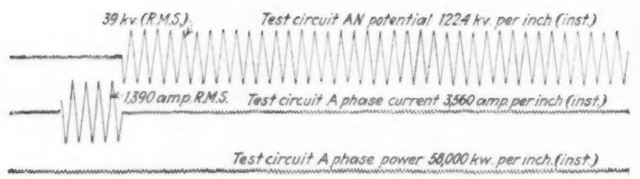
It was found, however, that under certain conditions of system operation proper 66-kv. ground protection was not possible without the use of a source of relay potential from the 66-kv. lines or buses themselves. Potential transformers having a ratio of 600/1 are therefore being installed on each 66-kv. bus section in all substations on the company's high-tension ring. The transformers are connected from each phase to ground, the system being operated with a 66-kv. neutral grounded through 63-ohm resistors at each power station. Power station transformers are connected 11 kv. delta to 66 kv. star.

Experience has shown it to be undesirable to connect potential transformers to a station bus without a protective device of some kind on the high-tension side, and also that it is somewhat impractical to fuse them low enough to protect the transformers themselves from damage due to internal or secondary trouble. Attempts to accomplish the latter have resulted in unjustified loss of protection or opening of circuit breakers on several occasions on the 22- and 11-kv. systems due to mechanical breakage or to blowing of the very small fuse links during system disturbances. These things being taken into consideration, it was deemed advisable to install 10-amp. fuses between bus and transformer, the aim being to protect the system and to maintain protective potential rather than to save the transformer from damage. The latter function is at least partially accomplished by fuses on the low-tension side. Referring again to experience with 11- and 22-kv. fuses, it was found that the Schweitzer & Conrad liquid fuse was quite satisfactory despite its original and renewal cost. An 88-kv., 100-amp. glass tube case containing a 10-amp. fuse link and mounted vertically on pin insulators set at 45 deg. was proposed for the potential transformer protection.

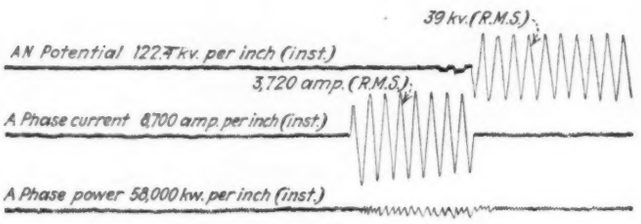
Before, however, adopting this fuse as standard it was determined to make short-circuit tests in order to learn its interrupting ability at 39 kv., the voltage to neutral of the 66-kv. system, inasmuch as this information was not available. The tests were made after midnight at Wilmerding substation, the scene of previous comprehensive 22-kv. oil circuit breaker and pole top switch interrupting capacity tests. There was here available a yard of considerable area and an extra 66-kv. oil circuit breaker suitable for applying short circuits to the fuses and for automatic protection in case of fuse failure. The fuses to be tested were mounted in a fuse holder of the type provided with them, the fuse holder being supported on stub poles and crossarms far enough from the station bus structure to be considered safe. The lower terminal of the fuse holder was solidly grounded and the upper terminal



Fuses similar to those tested installed for service with 66-kv. potential transformers


39 kv. (R.M.S.)
Test circuit AN potential 1224 kv. per inch (inst.)
1390 amp. R.M.S.
Test circuit A phase current 3560 amp. per inch (inst.)
Test circuit A phase power 58,000 kw. per inch (inst.)

Test No. 1


39 kv. (R.M.S.)
AN Potential 1227 kv. per inch (inst.)
3,720 amp. (R.M.S.)
A Phase current 6,700 amp. per inch (inst.)
A Phase power 58,000 kw. per inch (inst.)

Test No. 2

Oscillograms of two tests on 10-amp., 88-kv. fuses which cleared fault properly

connected to the 66-kv. bus through the aforementioned circuit breaker. At this point on the system there is available a phase-to-ground short-circuit current of 1,200 amp. with the power station neutral resistors in service (the normal scheme of operation) and 3,800 amp. with the resistors shunted out, a set-up occasionally used. By using different combinations of resistors shunted and unshunted it was possible to obtain fault current values between these.

All test faults were single-phase, line-to-ground short circuits and were applied by merely placing the fuse in the clips and closing the circuit breaker, only one pole of the latter being used. The current through and the potential across the fuse were measured by an oscillograph and the proper instrument transformers.

Eleven tests were made, two at 1,200 amp., two at 2,500 amp. and the remaining seven at the maximum current available of from 3,600 to 4,000 amp. The fuses cleared the short circuit each time before the relays on the test circuit breaker, which were set to close in 0.25 second, could operate. Throughout the eleven tests the breaker was opened only by hand, and then only after the fault current was cleared and the probability of a succeeding flashover was nil. Beyond an occasional slight blister around the rim of the upper brass fuse tube terminals there was no damage and all were suitable for refilling. The blowing of the fuse was accompanied each time by an explosive sound, as would be made by a shotgun, and a shower of sparks. The vent cap was blown out every time, thereby relieving the internal pressure due to volatilization of fuse link and liquid.

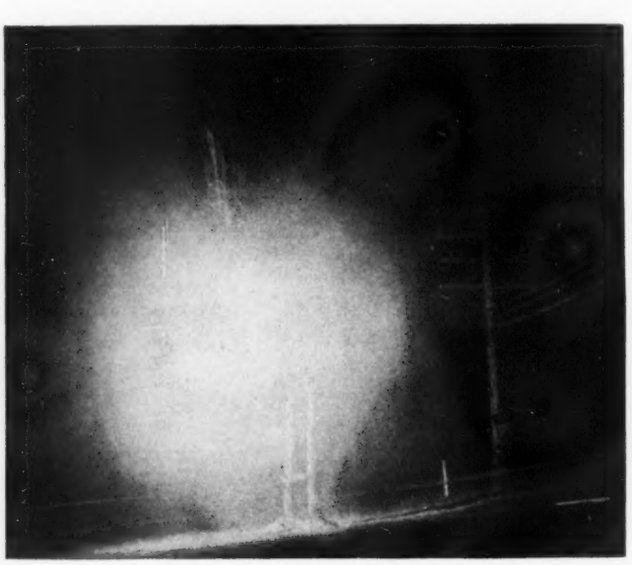
The oscillograph films show the fuses to have cleared in from four to nine cycles. The watt wave on test No. 9 shows a maximum r.m.s. of about 6,150 kw. to be dissipated in the fuse. Thirty-seven hundred and twenty amperes at 39 kv. is 145,000 kva. per phase, or 27,000 kw., using a system fault power factor of 0.185. Thus it is seen that the fuse dissipates, roughly, 22.8 per cent of the energy caused to flow by the short circuit and 4.3 per cent of the kilovolt-amperes. This helps to account for its high interrupting ability. The fuses were considered satisfactory and are being adopted.

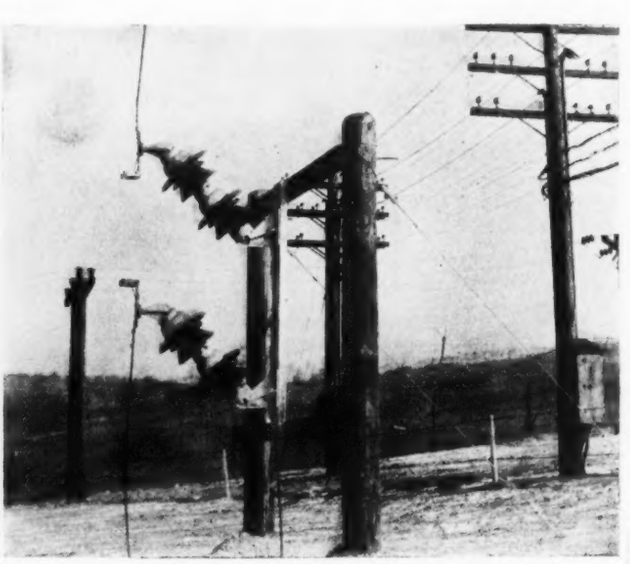
Wisconsin Has 155 Hydro Plants

OF THE 710 dams in Wisconsin, including those on boundary streams between Wisconsin and adjoining states, only 138 are operated by public utilities for developing hydro-electricity; seventeen are jointly used as hydro-electric plants and reservoirs, according to an analysis of Wisconsin's water-power situation written for the state Blue Book by Adolph Kanneberg, member of the Wisconsin Railroad Commission.

There are 185 dams in the state developing more than 100 wheel horsepower. Of this 185 only 38 have an installed wheel horsepower of more than 3,000 and only four dams are rated, or have installations of water-wheels, above 30,000 installed wheel horsepower. These develop a total of 158,800 wheel horsepower, or 27 per cent of the whole wheel horsepower developed by all of the 185 dams.

The total installed wheel horsepower of dams in the state is 361,748, the report shows. The total kilowatt-hours developed by water power in the "water year" (October to October) of 1927-28 was 981,795,000 and the total fuel power generation in the same period was 2,030,383,000.





An 88-kv. liquid fuse opening 3,720 amp. at 39 kv. (photo taken at night) and fuse mounting and test rack

Customer Psychology

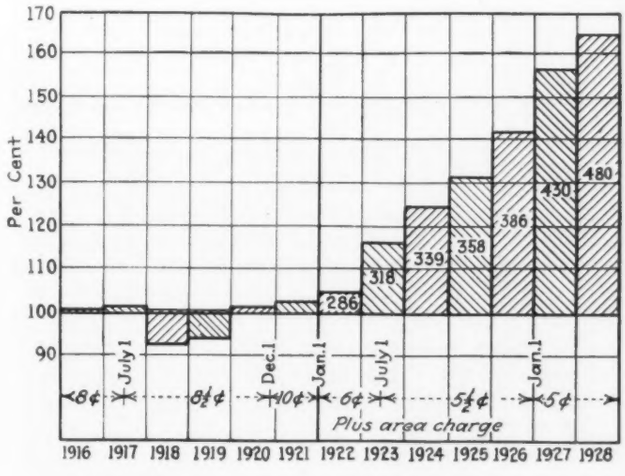
Hartford rates classify users and promote home electrification. Company establishes new schedule with 1.5 cents minimum energy rate

NEW household electric service rates with energy prices ranging from 5 cents to as low as 1.5 cents per kilowatt-hour were put in effect by the Hartford Electric Light Company Dec. 1. All of the 52,500 residential cutomers of this utility are offered the benefits of these rates, which establish three usage classifications as bases for future billing:

	Limited Use	Partial Use	Full Use
Flat rate per year per 100 sq.ft. of floor area	$0.60	$0.96	$1.80
Meter rate per kilowatt-hour	0.05	0.04	0.03 (1st 200) 0.015 (excess over 200)

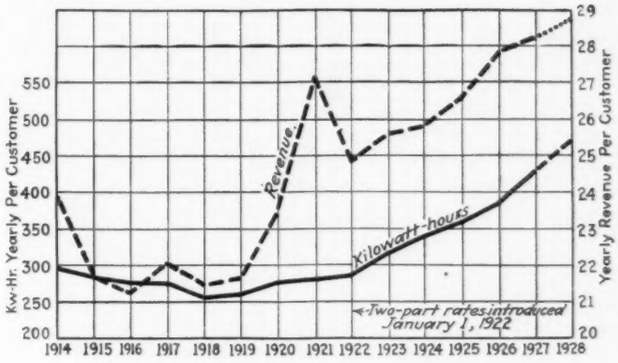
The "limited use" schedule applies to customers using only a small amount of service, such as lighting and a few labor-saving devices or none at all. Cooking, refrigeration, washing, ironing, etc., are done by other means. This schedule is optional and is the former two-part rate used in general household service on this system, but beginning Dec. 1 the company placed all its residential customers in one of the two other classifications, holding the "limited use" schedule for application to customers desiring to return to it after experience with the other classified rates.

The "partial use" schedule represents a second stage in the progress of the customer toward complete home electrification. It applies to a broader use of service and includes naturally a freer use of both lighting and appliances while still falling short of what might be called



Residence usage gained fast under improved rates

complete use. No hard and fast lines are drawn between the classifications, and the customer is given the opportunity to take service under whatever class he desires or thinks he is likely to most benefit by, considering his usage.



Growth of usage and revenue per residential customer

The "full use" schedule "is best suited to customers, in large or small homes, who wish to make full use of electricity for all domestic purposes, such as cooking, refrigeration, hot water heating, lighting, radio, motors or other miscellaneous services," the tariff states.

Before announcing the above rates the company made a study of its residential bills and energy consumptions and it found that about 2,600 customers should be billed on the "full use" schedule from the start. It goes without saying that the company will co-operate gladly with its customers in studying their individual takings of service and bills therefor, advising them as to the most desirable classification for their particular needs, just as the modern telephone company offers fair counsel with regard to rates and services.

Full-page advertisements in the local newspapers announced the new rates, stressing the low prices for metered energy embodied in them and setting forth the need of an entirely new viewpoint on the part of the customer to appreciate the value offered by these schedules to all customers wishing to turn to electricity for everything possible in their homes. Three examples were worked out for an average size of house area, which in Hartford is about 1,300 sq.ft.:

First Stage—"Limited Use"—The typical assumed customer uses, say, 15 kw.-hr. per month. He uses electric lighting in but one room at a time and his appliance usage is minor or negligible in importance. His bill on the old 5-cent meter rate, which is still available as an option if wanted, would be:

Amount meter—15 kw.-hr. at 5 cents	$0.75
Amount flat rate—1,300 sq.ft. at 5 cents per 100 per month	0.65
Total	$1.40
Average cost to customer per kilowatt-hour	$0.093

In this first stage customers utilize only a few of the possibilities of electricity, even though any added use costs only 5 cents per kilowatt-hour.

Second Stage—"Partial Use"—After using electricity

in his home for some time, this customer has gradually broadened his use of electric service. He likes good lighting, enjoys keeping his porch light going an hour or so each evening, does not take the trouble to turn off the lights every time he leaves a room, and his wife and family utilize a few labor-saving appliances. Experience has taught the customer that he can add these electrical conveniences at small cost on his former low meter rate of 5 cents per kilowatt-hour. He uses, for example, about 60 kw.-hr. per month, which has been costing him $3.65. On the new "partial use" schedule, which was formerly the company's so-called "cooking and refrigeration rate," his reduced bill would now be:

Amount meter—60 kw.-hr. at 4 cents	$2.40
Amount flat rate—1,300 sq.ft. at 8 cents per 100 per month	1.04
Total	$3.44
Average cost to customer per kilowatt-hour	0.057

The customer is now getting four times as much use as in the first stage and is paying only 2.5 times as much. Any additional use costs him but 4 cents per kilowatt-hour instead of 5 cents, as before, and only a little more use will bring him to a point where the "full use" schedule is better for him.

Third Stage—"Full Use"—This customer was pleased with "partial use" of electric service. He knows that he can get a low meter rate and he has decided to combine all his domestic services on one source instead of several. He seeks to utilize electricity as fully as he may be able to, and so he gradually extends his use of electricity for cooking, refrigeration, hot water heating, radio and all sorts of labor-saving appliances in addition to good lighting and plenty of it. In the same house he may use ten times as much electricity as before, but what is his bill?

Amount meter—200 kw.-hr. at 3 cents	$6.00
400 kw.-hr. at 1.5 cents	6.00
Amount flat rate—1,300 sq.ft. at 15 cents per 100 per month	1.95
Total	$13.95
Average cost to customer per kilowatt-hour	0.023

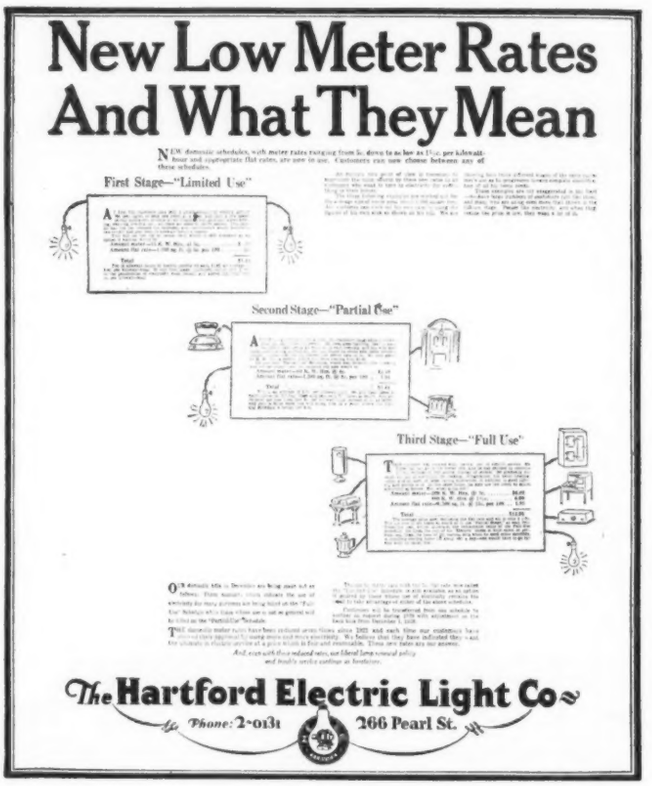
The use of service by the customer is now ten times as much as it was in the "partial stage" and at only about four times the cost, which illustrates the remarkable value of the "full use" schedule. He finds that the cost of operating his "electric home" is little more, or perhaps less, than the total of his various bills when he used other methods of doing household tasks or enhancing the comfort and convenience of living. For only 46 cents a day he enjoys a very complete electric home.

It is believed that as customers grasp the significance of these rates a substantial increase in the use of electricity in the home will follow. The follow-on benefits are plain to the layman with little or brief explanation, and in contrasting the advantages of the greater usage with the lesser and in the implications surrounding the limited and partial services classified, the company has sensed the potential responsiveness of the American householder to the possible removal of restrictions and given weight to the innate dislike of limitations inherent in this people.

Annual Kilowatt-Hours and Revenue per Customer Billed

Year	Annual per Customer Billed Kw.-Hr.	Revenue
1914	298	$23.96
1915	283	21.70
1916	274	21.28
1917	277	22.07
1918	254	21.45
1919	258	21.63
1920	277	23.44
1921	280	27.10
1922	286	24.84
1923	318	25.59
1924	339	25.79
1925	358	26.55
1926	386	27.86
1927	430	28.22
1928	480	28.80 (estimated)

In 1914 the average consumption per residential customer at Hartford was 298 kw.-hr. and the corresponding revenue $23.96. During the World War the existing straight-line rate of 8 cents was increased to 8.5 cents, and by the end of 1918 the consumption had fallen to 254 kw.-hr. and the revenue to $21.45. Near the end of



Advertisement announcing latest rate schedule

1920 it became necessary to raise the rate to 10 cents and this rate was maintained through 1921, the revenue for that year being $27.10 per customer and the consumption 280 kw.-hr. The situation was very unsatisfactory, and after a study of the problem the company established on Jan. 1, 1922, a two-part rate consisting of an area or flat charge of 60 cents per year per 100 sq.ft. plus an energy charge of 6 cents per kilowatt-hour.

The story of this rate and its application under adverse circumstances, the remarkable acceptance of it by the public after a year's trial and the results obtained were printed in the ELECTRICAL WORLD, April 21, 1923, page 917. The introduction of the rate, which marked the beginning of a policy of establishing a "power rate in the home" on a single meter basis, was the turning point in the residential business of the company. During the first year's application of this rate the use of energy rose only 6 kw.-hr. per customer and the revenue per customer fell to $24.84, but the public responded to

the opportunity given it, and in the seven years succeeding this first vital step the energy consumption has risen to 480 kw.-hr. (1928 estimate) and the revenue to $28.80. In July, 1923, the energy or meter rate was dropped to 5.5 cents and on Jan. 1, 1927, it was reduced to 5 cents. Although the energy consumption is now increasing faster than the revenue per customer, the latter is rising well above the levels of the earlier years and both bid fair soon to reach new values indicative of widespread public acceptance of the place of electricity in the modern home. The rate structure now available for full usage offers the customer the opportunity to obtain average prices of great attractiveness for a service which is fast becoming an absolute necessity to a prosperous and a comprehending civilization.

Increasing Applications of Daylight Lamps

By M. Luckiesh

Director Lighting Research Laboratory, National Lamp Works, Cleveland

OWING to the increasing interest in the quality of light produced by various artificial daylight units and tungsten daylight lamps it may be interesting to discuss the origin and status of the so-called daylight lamp. The gas-filled tungsten lamp produced a whiter light than the vacuum lamp which preceded it. The step toward white light was appreciable, but this new illuminant was still far from white light. Previous to the advent of the gas-filled lamp we had completed the researches necessary to enable us to make suitable colored-glass accessories for producing artificial noon-sunlight and north-skylight. The higher luminous efficiency of the new gas-filled lamp made such devices economically practicable in special fields. Their applications were limited because the efficiencies of the filters were necessarily 40 per cent and 15 per cent respectively.

The tungsten daylight lamp is a compromise between efficiency and quality of light. Noon-sunlight (white light) is practically of the same spectral character as light from the theoretically so-called "black body" at a temperature of about 8,900 deg. F. In other words, its color temperature is 8,900 deg. F. At present it is impracticable to operate the filament of a gas-filled tungsten lamp above 4,600 deg. F. The blue-green bulb of the tungsten daylight lamp raises the apparent color temperature to about 6,700 deg. F. This is obtained at the expense of 35 per cent of the light due to the absorption of the bulb. The result is that we have the tungsten daylight lamp, which provides light intermediate in color or spectral character between white light and that from the regular tungsten lamps with colorless bulbs. New applications of this lamp are being made yearly and many well-known fields are far from adequately cultivated. Color-vision is more important to us than we generally appreciate. As in the case of any phase of vision, we use it unconsciously for the most part. As lighting consciousness awakens, the applications and sales of tungsten daylight lamps increase.

The appearance of a colored object is not fixed or invariable. It depends primarily upon the spectral character of the illuminant and spectral reflection of the object, and secondarily upon many other factors such as contrast, brightness, size, etc. For the purpose of color standardization we contend that white light should be used. Rarely, however, is any one interested in a color for itself and by itself. Nearly always the color of an object is significant only relative to that of another object. In color grading the object is compared with an arbitrary standard.

In most cases of color grading any illuminant fairly rich in visible radiation of all wave lengths is satisfactory if the level of illumination is sufficiently high. The level of illumination is a very important factor in color work which has been unduly submerged by interest in an artificial light simulating noon-sunlight or north-skylight. However, experience has shown us that, in most of the cases of color grading in industry, it would be better to have a large amount of light of fair quality or spectral character than to have a meager amount of light of a daylight quality. It is becoming increasingly evident that high intensities of illumination from tungsten daylight lamps have many practical applications for color grading.

We have recommended the tungsten daylight lamp for the color grading of many kinds of products and have specified levels of illumination running into hundreds of foot-candles. For example, there are paint shops using 50 foot-candles, and in a tile factory color grading is being done under 150 foot-candles. On every hand it appears that there are color problems which can be solved in this manner.

We recently recommended a lighting installation for a factory where fifty operators are engaged in color grading of moderately dark, glossy buttons. Background is important in such work and we found a dull black to be best. Owing to specular reflection from the buttons, diffused light or light from a large source close to the work was unsatisfactory. We found that fairly concentrated light from one side, or both sides, minimized the annoyance of specular reflection. After experimenting with various natural and artificial illuminants, we concluded that the best level of illumination for these buttons, of low reflection factor, was in the region of 300 to 500 foot-candles, and that the quality of light from tungsten daylight lamps was satisfactory. As a result, we recommended a minimum of 100 foot-candles (preferably 200 to 300 foot-candles) obtained with tungsten daylight lamps.

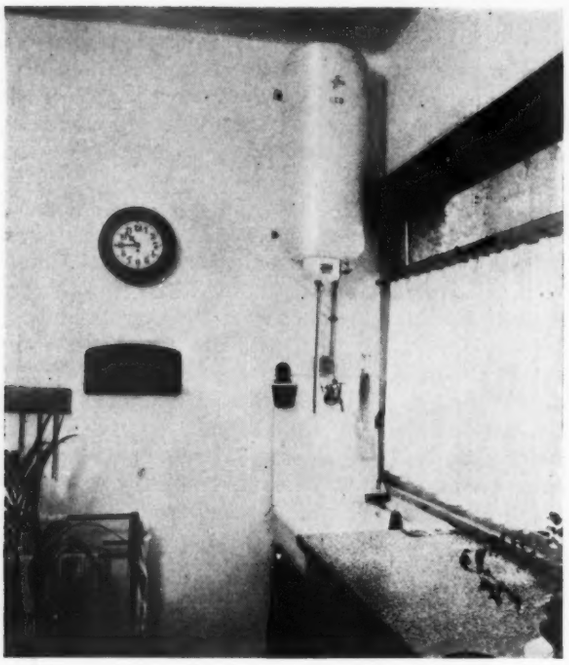
Purchased Power for Railroads*

By Gen. W. W. Atterbury

President Pennsylvania Railroad

"WE WORKED out a jointly owned power-plant scheme with the United Gas Improvement Company and the Philadelphia Electric Company, but decided not to go into it. Why should we enter the power business? We have no warrant to go into that business, which is an industry by itself. By the time we are ready to use it, we shall be buying power cheaper than we can make it ourselves and thereby saving a capital investment of from twenty million to thirty million over a great number of years."

**From address before Boston Chamber of Commerce.*



Installation of small heater at kitchen sink minimizes radiation losses in piping

Water Heating

A most desirable off-peak load is being built up by sale of night energy at low rate for domestic water heating. Methods of installation

IN AN article on "Residential Water Heating," by Herrmann and McClurg, in the ELECTRICAL WORLD, Feb. 18, 1928, the authors present the system in which the hot water problem is solved in the area of the Northern States Power Company. Perhaps it might be of interest to report on some experience obtained in electric water heating in Europe, and therefore some details of the system introduced at The Hague, Netherlands, are given.

In general, the opinion exists that a low rate for energy used during the night hours is of great importance in water-driven power stations especially; that such need not be the case may be shown by the fact that the following notes refer to steam-driven power stations.

Conditions in Europe are such that a market for night energy for water-heating purposes is to be found if the price per kilowatt-hour does not exceed the figure of 2 Dutch cents (equivalent to 0.8 American cent), which is shown by a long practice in Switzerland, where on account of the extensive use of water power a very good night load has been built up by a number of supply companies.

A couple of years ago such a price was quite impossible in a thermal station; in the first place, the price of coal was as high as 60 Dutch guilders ($24) a ton in these days and in the second place the station efficiencies were much lower than nowadays. Happily, at present the price of coal is practically down to the pre-war figures, and on the other hand the thermal efficiency of the power stations has been raised to such a figure that a price of 2 Dutch cents per kilowatt-hour for night energy is no longer impossible.

Large size (about 50-gal.) electric water heater used in creamery

CONDITIONS FOR NIGHT SERVICE

Keeping in mind that in most cases the night load is low on account of the absence of large chemical industries, the cost of the energy supplied at night is not to be debited by capital charges nor maintenance charges in the power station. As far as the generating expenses go only the cost of coal per unit on the 24-hour basis has to be taken into account.

Even at a price of 15 guilders ($6) a ton for coal of 13,500 B.t.u. per pound the present efficiency in steam-driven stations is such that the coal cost for the units for night energy is below 1 Dutch cent per kilowatt-hour. As, further, in the distribution network no capital charges are to be carried by the night current, it will be clear that a selling price of 2 Dutch cents per unit against a cost price of 1 Dutch cent per unit is quite an attractive proposition.

These considerations will only hold in the case of the fulfillment of all the conditions mentioned above, which necessitates that a time switch has to be installed which switches the current on during the night hours only and keeps the load off the station during all the other time.

On the other hand, the night load even locally has to be smaller than the normal day load. If, for instance, a consumer should concentrate a large night load in a certain part of the network his night energy should have to carry a certain part of the transmission costs, which means that the price of his night energy had to be raised accordingly.

One method of selling the night energy would be to leave it to the customers to buy their electric water heaters and to supply them with night energy through a special meter. This system has many disadvantages and therefore in The Hague the heaters are installed by the corporation. The load is exactly known in that case and by multiplying it by the num-

by Electricity

at The Hague

By G. J. T. BAKKER
City Electrical Engineer The Hague, Netherlands

ber of hours that the heater is switched on the number of kilowatt-hours consumed per month is known. In that way no metering is necessary and the consumer pays a fixed monthly charge, in which the monthly rental of the whole installation is included as well as the cost of the energy.

EFFECT ON LOAD AND REVENUE

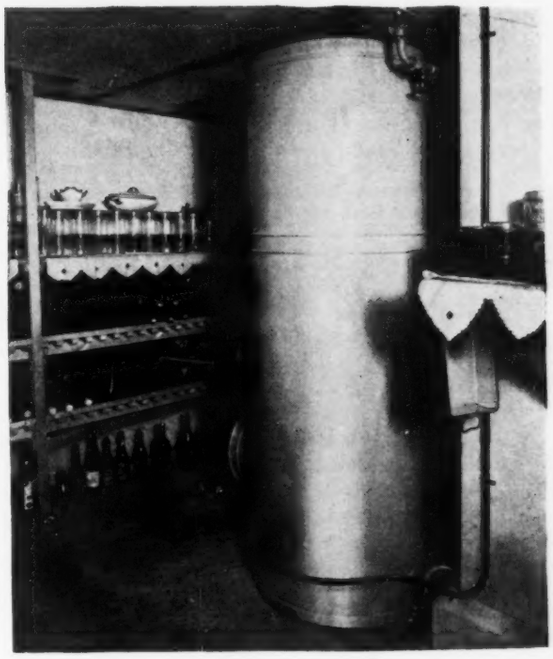
If desired, it can be taken into account that the annual consumption is lower than 365 times the maximum possible daily consumption, as the consumers do not use all their hot water every day.

If the number of hours in which the current is switched on remains constant it is easy to influence the station load curve in any desired way by staggering the hours of switching on for different consumers.

Another question is, is a night load at a price of 2 Dutch cents per kilowatt-hour in any way attractive to the supply company. That such is the case may be deduced from the following considerations:

The introduction of the night current increases the total number of kilowatt-hours used by the customer very appreciably.

The consumption for light, for instance, in The Hague in a workman's house was from 70 to 80 kw.-hr. per annum. If a flat iron is used, the number of kilowatt-hours increases to 90 to 100 per annum.

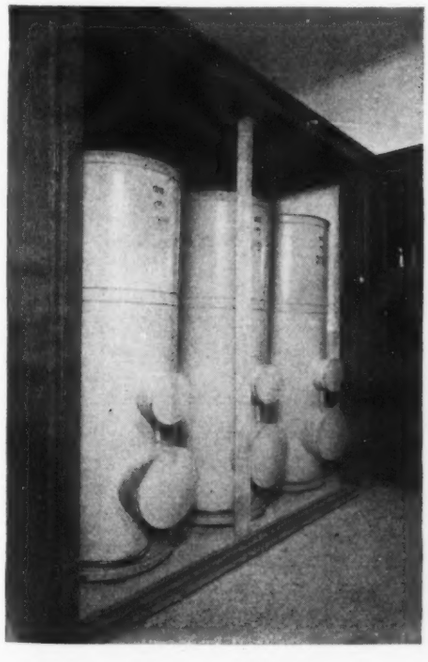


Basement installation of electric water heater in home

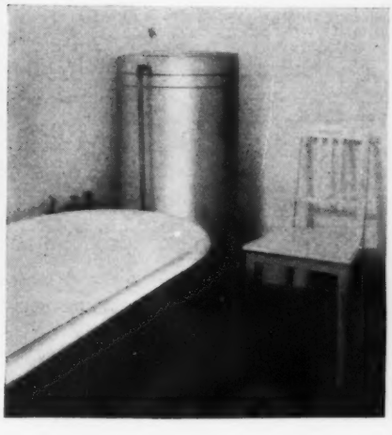
A water-heating tank of 30-liter capacity (7.9 U. S. gallons) increases the annual consumption by 900 kw.-hr., bringing the total to 1,000 kw.-hr. per annum; that is, ten times the original consumption.

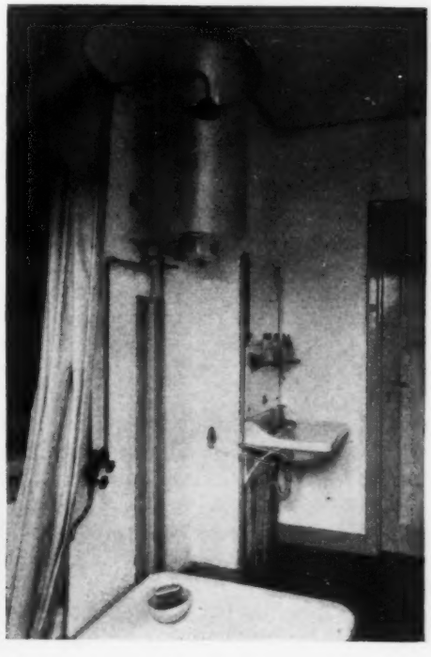
As to the financial side of the problem, I should like to point out that the 70 to 80 kw.-hr. for lighting is charged at 20 Dutch cents (8 American cents) per kilowatt-hour; that is, 14 to 16 guilders a year.

Against this the 900 kw.-hr. for water heating is charged at 18 guilders per annum, the cost price of the latter being below half of the selling price, which in no way is the case with the units sold for lighting, as, generally speaking, on the selling price per unit for lighting



Bank of three 200-liter (52.8-gal.) electric water heaters for heavy requirements and two typical bathroom installations





for small consumers there is only a very small margin compared with the cost price. Thus, as a paying proposition, the night current is much better than the current for lighting.

The corporation at The Hague introduced four types of water tanks, as shown in the following table:

Capacity	Annual Consumption in Kw.-Hr.	Monthly Charge
30 liters (7.9 gal.)	900	2.50 Dutch guilders ($1.00)
50 liters (13.2 gal.)	1,500	4.00 Dutch guilders ($1.60)
120 liters (31.7 gal.)	2,900	7.50 Dutch guilders ($3.00)
200 liters (52.8 gal.)	4,000	9.00 Dutch guilders ($3.60)

As mentioned above, the monthly charge includes the rental of the apparatus. The charge is relatively low, but as the corporation is in a position to buy the water heaters in large quantities their initial cost is relatively small. A further advantage gained by the corporation purchasing the heaters is that in this way the quality of the apparatus will be better than if bought individually by the consumers.

Co-operation from Plumbers

The connecting up of the tanks and time switches to the corporation mains and the connection to the water mains, the blow-off valves and the non-return valves, prescribed by the city water board, are done by local contractors, who have proved to be good advertising agents for the system, inasmuch as an installation of a city water heater will very often bring them an order for the installation of a hot water system on the consumer's premises.

To give more freedom to the consumer as to the location of the heaters, the latter are put under the water pressure of the city water main. This involves that during the day the hot water which is used is replaced by cold water. It has been proved that there is very little mixing of the hot and the cold water.

The tanks up to the present are made of galvanized iron. Some trouble is experienced as to corrosion of the tanks by the city water. The corrosive action depends largely on the temperature to which the water is heated. It has still to be shown by experience if the trouble will be fully overcome by lowering the final temperature to which the water is heated. Another way to prevent corrosion is by cementing the inner surface of the tank or, more radical still, by dealing with copper tanks altogether.

For the larger tanks this would mean a big increase in initial costs, and therefore the experiment with copper tanks has been made only with the smaller ones, of 30 liters (7.9 gal.), which involves only a very small increase in price.

In The Hague no continuous heater is installed, as a higher price for the energy used during the day would have to be charged. The insulation of the tanks, however, is excellent, with the result that the heat losses are small.

The tanks are used for the following purposes: A 30-liter tank gives all the household water for a workman's house; a 50-liter tank the same plus two shower baths a day; a 120-liter tank to be used for a bath; a 200-liter tank, domestic water plus bath for a small family. For bigger families a combination of tanks of different sizes can be made.

When considering this it has to be taken in mind that the water is heated up to 85 deg. C., which means that for practically all purposes it has to be mixed with a large amount of cold water.

For time control a very good record is shown by a synchronous time switch built on the lines of the General Electric Company automatic time switch, redesigned by the A.E.G. of Berlin to suit European conditions.

The system has proved to be a great success and the number of applications from the consumers has been large. Starting about a year and a half ago, in the first year about 1,000 tanks were installed and in the second year it is expected that another 2,000 will be added to the total number.

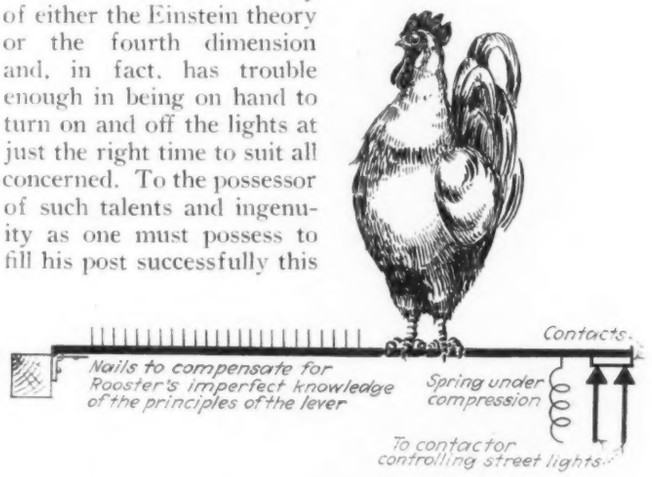
Letters from Our Readers

New Street Light Controller

To the Editor of the Electrical World:

In a little North Carolina town there is a Superintendent of Public Works whose duties cover, among other things, the operation with his own hands, unaided, of the electric light system, water works system, volunteer fire department, maintenance and repair, meter reading, replacing blown fuse plugs when some good housewife's flat iron acts up, and so forth.

Needless to say, our unsung hero has no great amount of time to devote to the study of either the Einstein theory or the fourth dimension and, in fact, has trouble enough in being on hand to turn on and off the lights at just the right time to suit all concerned. To the possessor of such talents and ingenuity as one must possess to fill his post successfully this did not present an insuperable problem. In his back yard is a hefty rooster of staid and dependable habits whose belief in the "early to bed and early to rise" habit is unshakable.


Contacts
Nails to compensate for Rooster's imperfect knowledge of the principles of the lever
Spring under compression
To contactor controlling street lights

Cornfed "astronomic" street light controller

Here, then, are the problems and the elements of its solution: A special perch was arranged for friend rooster pivoted at one end and so arranged that his weight would depress the perch a few inches to pull down on a cord to close the street lighting circuit regularly at dusk and to open it when old reliable leaves his perch at break of day.

To the best of my knowledge there is no device on the market today capable of taking cognizance of the early dusk on a rainy day or late darkness on a clear day or of the variable hours of dawn with the changing weather as does this old rooster.

L. H. Hardin,
Electrical Engineer.

Mees & Mees, Consulting Engineers,
Charlotte, N. C.

Digest of Electrical Literature

Transmission, Substations and Distribution

Nomograph for the Determination of Capacitance and Capacity Susceptance Between Wires.—C. ALBERT KULMANN.—One of the first steps in solving any of the transmission line formulas is to determine susceptance and impedance. While most handbooks give tables of these values, interpolation almost always is necessary, and if done accurately takes almost as much time as solving the equations. With the nomograph a quick, accurate solution is made possible. The chart goes beyond the usual tables in giving the values both per 1,000 ft. per mile and including a wide range of frequencies. In using the chart with a straight edge on the scale points corresponding to the given values of wire size and spacing, read the desired value of capacitance between wires from the center scale, as indicated by the point of intersection of the straight edge with that scale.—*Electrical West*, March 1, 1929.

Virginia's Progress in Rural Electrification.—CHARLES E. SEITZ.—Five of the leading electric utilities of Virginia reported 1,500 farm customers in 1926, while the same companies had approximately 5,000 actual farmers on their lines at the end of 1928. These five companies have 408 rural lines totaling 1,200 miles in length and expect to construct approximately 500 miles of rural lines during 1928. Two of these companies have organized rural service departments with qualified agricultural engineers in charge. The three other companies expect to employ such men this year. This interest on the part of the utilities is due to some extent at least to the investigations undertaken by the Virginia Committee on the Relation of Electricity to Agriculture, which was organized in 1924.—*Electrical South*, March, 1929.

Electrical Insulating Papers for the Manufacture of Power Cables.—T. N. RILEY and T. R. SCOTT. — Previous work on the subject of paper as a cable-insulating material is briefly reviewed. It is shown that in the past attention has been directed too exclusively to the fiber stock and the relation of the physical structure to the electrical properties has been relatively neglected. The characteristics which a cable-insulating paper should possess are outlined. Briefly, these are high electric strength, high oil absorption, low electrical conductivity, high mechanical strength and permanence. The results of tests designed to determine the relation of the paper structure to these qualities are then quoted and discussed. From these tests it is concluded that a satisfactory paper for power-cable insulation should have the fibers closely packed to give low bulk while still retaining high absorbency. The fiber packing should not be obtained by heavy surface calendering. The methods of test employed and the influence of the manufacturing processes on the product are briefly discussed in appendices.—*Report of the Institution of Electrical Engineers (England)*, March, 1929.

Safe Operation of Rotary Converters.—R. E. POWERS.—To secure satisfactory results from synchronous converters it is essential that they be properly applied and that the switching equipment protect the units from service faults and disturbances. Proper indicating devices to show the character of both the alternating-current and direct-current loads are essential. The alternating-current machine breaker should be of the over-current automatic type adjusted for inverse-time or definite-time trip, depending upon the application. Where selectivity is desired between opening the direct-current feeder breakers and the alternating-current machine breakers, a non-automatic alternating-current breaker equipped with a shunt-trip or direct-trip attachment is necessary. To trip the breaker the impulse is secured by the action of sensitive induction type over-current relays that have definite minimum inverse-time characteristics.—*Power*, March 19, 1929.

The Factor of Safety of Overhead Lines.—W. FORDHAM COOPER.—A factor of safety may be considered as an insurance against the incidence of abnormal stresses or the presence of defective material, and in this article the mechanical properties of the materials are considered. Such materials are steel plates, copper and aluminum. Variations and inclusions of macroscopic orders which will not materially weaken a steel plate or even a tensile specimen may affect a whole cross-section of one strand of a steel cable and thus we may expect a greater variation of properties. In the case of copper and aluminum, however, such macroscopic variations are not to be expected, especially when the materials are prepared electrolytically and are in a comparatively pure state, whereas steel is essentially a very complex structure and experience shows that the properties of copper and aluminum cables are more constant than are those of steel. It has been found that: It appears that a comparatively small factor is necessary to guard against unsatisfactory material, and in the case of a suspended wire the stress does not increase nearly so quickly as the loading due to the peculiarities of the catenary; though the excess load which can be carried without a permanent set will depend on the load corresponding to the yield point, the actual safety will also depend on the amount of plastic deformation which can occur before the line becomes really dangerous. It may be asked whether preparations should be made to replace a badly stretched wire if a tornado occurs or put in one that will withstand an earthquake.—*Electrician (England)*, March 22, 1929.

Generation, Control, Switching and Protection

Direct Generation of Alternating Current at High Voltages.—A brief description of a 33,000-volt, 25,000-kw., 3,000-r.p.m. alternator built for the North Metropolitan Electric Power Supply Company, England, with a description of the stator winding, which is made up of special conductor bars of three conductors each with what has been designated as bull windings, inner and outer windings. The bull conductors of each phase are connected in series and then connected to the surrounding inner conductors, which are again connected in series and finally connected to the outer conductors which are starred to the ends of the corresponding conductors of the remaining two phases and grounded. A wiring diagram of the conductor connector is given and also a cross-section drawing of the conductor slot arrangement which is rather special.—*Engineer (England)*, March 22, 1929.

Units, Measurements and Instruments

Oscillographs for Recording Transient Phenomena.—W. A. MARRISON.—Oscillographs which automatically record amplitude, wave form, frequency, duration and the time of any electrical disturbances for which they are adapted as developed for recording transient phenomena are described. Two instruments are described for recording very short or very long transients; they may be used in combination. At power frequencies, satisfactory records may be made on films or sensitized paper with a two-watt lamp. The instruments and their performance are illustrated by photographs and oscillograms.—*Journal of the American Institute of Electrical Engineers*, April, 1929.

Portable Measuring Desk. — A. HEILANDT.—Measuring the power consumption of electrically driven machines or tools in the workshop commonly involves much detailed preparation in the connection of electrical instruments and thus results in an appreciable loss of time. Similar difficulties arise when demonstrating or investigating individual working processes in the workshop. Such experiments are facilitated if all measuring instruments are assembled on a com-

mon measuring board and are always available for service. An equipment of this kind is the A.E.G. portable instrument desk. The desk, comprising measuring instruments, connections and other accessories, is mounted on a portable framework. The test values are registered by a recording wattmeter, which not only registers the momentary input in kilowatts but also enables the kilowatt-hour consumption during any interval of time to be ascertained. — *A. E. G. Progress (Germany)*, March, 1929.

Motors and Control

Application of Double-Cage Motors.— ST. HALAS.—Squirrel-cage motors are ideal machines in so far as they are cheap, dependable, very simple to control and require but little attention. Although these motors are superior to the slip-ring type as regards robust construction and working, it cannot be denied that their starting conditions leave much to be desired. The heavy rush of current at starting causes voltage fluctuations. It is also very difficult to safeguard effectively squirrel-cage motors against overloads as the fuses or protective switches invariably function during the starting period unless rated for higher currents, in which case they offer no adequate protection. A further disadvantage of the ordinary squirrel-cage motor is the fact that the starting torque increases in jerks. This accelerates wear of the belting, spur gearing or other means of transmission, which again not only has a detrimental reaction upon the driven machines but also upon the goods manufactured. Thus it is practically impossible to drive certain textile machines by means of ordinary squirrel-cage motors as rapid starting causes breakage of the threads and similar disturbances. The introduction of the double-cage motor can be regarded as having surmounted all the objections to the squirrel-cage type of motor. Although double-cage motors are just as simple as the ordinary squirrel-cage in respect to mechanical details, yet they possess far better starting characteristics. They are used for such purposes as on cranes, lifts, machine tools, to operate transmission shafting of all kinds, pumps, fans, compressors, excavators, capstans and conveying plants as well as in the paper and textile industry.—*A.E.G. Progress (Germany)*, March, 1929.

Illumination

Burn-out of Incandescent Lamps.— GORTON R. FONDA.—That the present incandescent lamp with tungsten filament has been brought to a high state of perfection is common knowledge. In addition to the advantages coming from the fundamental researches on drawn wire and on gaseous filling, there have been notable achievements on the part of the development laboratories and engineers. They have not only succeeded in obtaining the inherently high efficiencies possible but they have taken full advantage of all the inherent incidental features and have produced lamps of remarkable strength. Due to modern skill, the human individual is now counting on attaining fully his allotted life of threescore years and ten unless interrupted in his course by some action of positive violence. Lamps have been similarly fortunate. Their physical character is now such that they are capable of surviving all of the ordinary hazards and attaining a life which is limited only by exhaustion of the filament, caused by what is known as "burn-out."—*General Electric Review*, April, 1929.

Heat Applications and Material Handling

An Improved Form of Electric Resistance Furnace.—W. ROSENHAIN and W. E. PRYTHERCH.—Existing types of electric resistance furnace, whether for laboratory or industrial use, suffer from certain limitations. Those which are heated by means of wire resistances are limited as to maximum temperature by the nature of the wire. Those of the high-melting metals, such as tungsten, molybdenum, etc., is rendered difficult by the necessity of heating them either in a neutral atmosphere or in vacuum. The platinum metals are excessively expensive, except for quite small furnaces, while wire windings of nickel-chromium alloys can rarely be used for any length of time at temperatures exceeding 1,200 deg. C. On the other hand, furnaces working with carbon resistors either entail the use of heavy currents or, where granulated carbon or similar material is employed, suffer from the difficulty of securing and maintaining uniformity of heating throughout the resistor. In the carbon-resistance furnaces as hitherto constructed, moreover, combustion of the carbon has to be prevented by maintaining around it a neutral atmosphere, such as hydrogen or nitrogen, and, in these circumstances, the presence in the furnace of a strongly reducing carbon-bearing gas can scarcely be avoided. — *Engineering (England)*, March 15, 1929.

Electric Melting Pot for White Metals. — HAROLD K. SELLICK. — Furnaces, or melting pots designed for melting white metals and alloys, may be roughly divided into two classes: Those for leads, zinc and type metals having a melting point under 800 deg. F., and those for aluminum and die-casting alloys melting at approximately 1,200 deg. F. The advent of the electric melting pot into the white metal (or soft metal) has brought about many desirable changes in the practice of babbitting. The electric pot shows many advantages, such as close temperature control, reduction of man-hours for a given job due to automatic temperature control, full automatic control by a time clock, no fumes or odors from unburned fuel, spoilage by overheating eliminated, uniform heating of metal eliminates hot spots, metal temperature known at all times and increased life of vessel due to absence of flame.—*Iron Age*, March, 1929.

Miscellaneous

"Lighting" Hens in Winter.—J. E. DOUGHERTY.—Does it pay to use artificial lighting in the laying house in winter? Increased interest in rural electrification has resulted in some over-zealous claims regarding the application of electricity on the farm. The author has prepared this paper with the idea of giving those interested in the use of electric lights in hen houses a more accurate understanding of the purpose of such lighting.—*Electrical West*, March 1, 1929.

Hot-Cathode Thyratrons (Part I—Characteristics). — ALBERT W. HULL. —The thyratron is a three-electrode tube similar to the pliotron, into which, after exhaust, a small amount of inert gas has been introduced. The presence of gas changes the pure electron discharge into an arc, so that the thyratron is an electrostatically controlled arc rectifier. As might be expected from its arc character, its behavior and electrical characteristics are very different from those of the pliotron. It is inferior to the pliotron in one important respect, in that the grid does not control the instantaneous value of the plate current, but only its average value. On the other hand, it is free from the limitations to power capacity and efficiency which are imposed upon the pliotron by space charge. The efficiency of hot-cathode thyratrons at 500 volts and conservative life rating is approximately 97 per cent, including cathode heating. The power capacity of the largest unit that has been made is 100 amp. at 10,000 volts. There is no apparent obstacle, either theoretical or practical, to the construction of a unit of ten times or even 100 times this capacity.—*General Electric Review*, April, 1929.

What Will Copper Do?—ARTHUR B. PARSONS.—The questions that many would like to have answered are: How long will copper stay at 24 to 27 cents? How fast will it go down when it does drop? At approximately what price ought it to reach reasonable stabilization over a period of years? One must start with the fundamentals to answer questions such as consumption; production; unit cost of production, etc. There are also four collateral factors that must be taken into account in explaining the recent behavior of the metal market and in analyzing the future. These are: The market for shares in metal mining companies; the Copper Institute, an organization through which comprehensive statistics of production, sales, selling prices and consumption of copper are made available; the progress in the merging of producing companies and the psychology of buyers, taken collectively.—*Engineering and Mining Journal*, April 6, 1929.

Book Reviews

Speech and Hearing

By Harvey Fletcher. New York: D. Van Nostrand Company, Inc. 331 pages, illustrated. Price, $5.50.

The theory of sound, beginning with a description of the speech organs, production of speech sounds, both natural and artificial, the frequency of speech sounds and, in brief, the amount of power required to produce them. Recording instruments such as the phonautograph, the phonograph and the oscillograph are described. Acuteness and the limits of hearing are dealt with, as are the developments of the audiometer and the principles of recognition and masking of sounds. The loudness of sounds, the recognition of the pitch of musical tones, methods of measuring the recognition of speech sounds, the effect of changes in their received intensity, effect of frequency distortion upon the recognition of speech sounds, effect of other types of distortion upon hearing and the effect of noise and deafness upon the recognition of speech sounds are dealt with in this book. An important part of the topics presented in the book has been to determine the degree of precision with which the mind can differentiate and interpret sounds quite similar. It should make an excellent guide for laboratory work.

Operational Circuit Analysis

By Vannevar Bush. New York, N. Y.: John Wiley and Sons, Inc. 392 pages, illustrated. Price, $4.50.

Short cut methods to arrive at the solutions of electrical problems are very useful. The symbolic treatment is readily used by many engineers to solve steady state circuit problems without their having a mastery of the mathematics involved. In transient circuits Oliver Heaviside first used a short cut method to obtain circuit solutions to the horror of the classical mathematicians of his day. But the Heaviside operational calculus method has proved its value and has become a very useful tool to engineers. For many differential equation solutions of electric circuits the operational calculus may be used as a slide rule, so to speak, to get an answer and the computer needs to know little of the underlying mathematics.

But it is dangerous to use short cut methods generally without knowing their limitations as well as their advantages. So in this book Professor Bush has developed the theory of operational calculus and has tied it to classical mathematics on the one hand and to practical circuit problems on the other. He has built a logical and well-illustrated text to give engineers a basic knowledge of the new mathematical tools so useful in dealing with transient conditions in electric circuits. Many illustrations and the use of problems help to clarify the text and an appendix by Prof. Norbert Wiener discusses mathematical aspects of the calculus. The book is written by an engineer for engineers and is the expression of several years' teaching of the subject to graduate students. It can be recommended highly to engineers and students.

How to Wind Direct-Current Armatures

By W. E. Henning. Second edition. Milwaukee, Wis.: Bruce Publishing Company. Cloth, 7x10 in., 205 pages, illustrated.

In this revised second edition the following subjects have been added: Terms and symbols; additional examples illustrating the application of the various factors that enter into armature-winding calculations; testing wave-wound armatures; calculating field coil windings, and a comprehensive treatment of the so-called "frog-leg" windings This book is the outgrowth of a course of lectures given by the author to the electrician students at the School of Engineering of Milwaukee

Mathematical and technical discussions have been avoided as much as possible, and where their use is necessary they have been shortened and made clear, all of which will enable the practical armature winder to obtain a better understanding of the fundamental principles involved.

Although it is not a treatise on the design of armature winding, it may be used by the engineering student as well. The first chapter is devoted to direct-current winding classification. Next, lap-winding diagrams, two-circuit or wave windings, and special windings, followed by construction and winding of form-wound armature coils, are discussed. Other chapters take up, in sequence, armature testing, fundamental equations, adapting a.c. machines to changed conditions, examples of voltage changes and an appendix of useful information and formulas.

Distribution of Electricity by Overhead Lines

By William T. Taylor. London: Charles Griffen & Company, Ltd. 261 pages, illustrated. Price, $6.50.

This book is written for engineers engaged in the planning, construction and operation of overhead distribution lines. The chapters treat of the distribution system, aspects of location and design of distribution lines, calculations for distributed design, the general distribution system and aspects of distribution maintenance. Practices from all countries are recorded and discussed, but the present electrical conditions in Great Britain are noted and the book deals with them very largely. The general system advocated is the three-phase, four-wire with the ground wire used as a circuit on the poles and insulated, but all systems are discussed.

The author has many data incorporated in his book that are useful. He discusses the problems of distribution fearlessly and offers stimulating suggestions. Whether they agree or not with the author, distribution engineers will find the book useful and interesting.

Conduction of Electricity Through Gases

By Sir J. J. Thomson and G. P. Thomson. Cambridge University Press. New York: The MacMillan Company. Third Edition, Vol. I. 491 pages, illustrated.

In the revision and enlargement of the early edition Sir J. J. Thomson has had the assistance of his son Prof. G. P. Thomson and the present scope of the work is so great as to require two volumes. In the first volume the authors cover the following aspects of the subject: Conductivity of gases in normal state, properties of a gas when in a conducting state, mobility of ions, mathematical theory of gaseous conduction, magnetic field effects, ratio of charge to mass of ions, charge of negative ions, physical properties of gaseous ions, ionization by incandescent solids, ionization in gases from flames and ionization by light. The thorough treatment of the subject will continue to make this work rank as a classic on gaseous conduction.

Book Notes

ELECTRICITY UNIT, Part 1. By H. C. Thayer. New York: McGraw-Hill Book Company. 15 pages, illustrated. Price, 35 cents.

Splices, solders, taping practices, wire construction and methods of making joints outlined as to methods of performance and variations for use by Wisconsin State Board of Vocational Education. Consists of process instruction sheets for fifteen operations.

HANDBOOK OF HYDRAULICS. By H. W. King. New York: McGraw-Hill Book Company. 523 pages, illustrated. Second edition. Price, $4.

This well-known handbook for the solution of hydraulic problems has been revised and enlarged. It is complete with tables and formulas and new chapters have been added dealing with critical depth and hydraulic pumps. Many new tables have been added and the entire text has been rewritten.

PROBLEMS IN ALTERNATING-CURRENT MACHINERY. By Waldo V. Lyon. New York: McGraw-Hill Book Company. 243 pages, illustrated. Price, $2.25.

An experienced teacher such as Professor Lyon realizes the value of good problems in an engineering course. In this volume he has presented a splendid series of problems dealing with the principal types of alternating-current machinery. The problems are practical, clearly stated and are graded and arranged to fit the necessities of class work.

Books Received

Moderne Lichttechnik. By J. Teichmüller. Berlin: Deutsche Beleuchtungstechnische Gesellschaft E. V. 125 pages, 90 illustrations. Price, 6.50 reichsmarks.

Chains of Lightning. By Jonathan Brooks, Indianapolis: The Bobbs-Merrill Company. 313 pages. Price, $2.

News of the Industry

Lighting the Convention at Atlantic City

Equipment of the most modern and effective kind will be used to light Atlantic City's great new convention hall, which is to be formally opened for the N.E.L.A. convention and exhibition on May 31. Unusual color lighting effects as well as high intensity and easy control are to make the installation notable.

The auditorium, in which 40,000 persons can be seated, measures approximately 300 ft. x 480 ft. Over it extend eight trusses and the half sides of two others, all of these supporting the roof and being 135 ft. above the floor at highest point. Inside of these trusses, which are 12 ft. wide, are placed 1,500-watt floodlighting projectors spaced above 14 ft. apart. They project light to the ceiling, which is finished in "celotex" and aluminum paint.

Thirty color screens are geared to small motors so that one-half these screens are operated on each side. To obtain any color desired a button is pushed on the stage and the screens stop with a 2-ft. opening in front of the projectors. About 540 projectors are used. Openings in front of them are also equipped with prismatic diffusing plates. A pilot-light system and dimmer-control method are incorporated to operate all equipment from the stage.

In the ballroom, which will seat five thousand and which has a 90-ft. ceiling, indirect color and general illumination are accomplished by the cove and lunette method. One hundred and thirty-six 250-watt floodlamps are set in arches and covers and equipped with daylight lenses. Alternate red, blue, green and other colors are obtained with many of these projectors fitted with color screens. In addition, there are 26 lunettes with 36 smaller lamps in each. Varied color effects and dimmer control are obtained from the stage. The total connected load of the convention hall will be 1,442 kw.

Consumers Power Company to Build New Hydro Plant

Application for a permit to construct a 100-ft. dam on the Muskegon River at Oxbow has been filed by the Consumers Power Company with the Newaygo County (Mich.) Board of Supervisors. The site is 6 miles upstream from the company's present dam at Croton, 32 miles north of Grand Rapids. The new dam, with a length of 3,500 ft., will be the largest in Michigan. It will make possible a hydro-electric generating plant with a capacity of 40,000 hp., produced by three units.

The dam will be of reinforced earth-work with a heavy reinforced-concrete core wall from base to crest and either a concrete or welded facing for the embankment on the up-river slope. A reservoir with a maximum depth of 100 ft. will be formed. It will be about 18 miles long and a mile and a half wide at its widest point. This lake will have a shore line of 48 miles. Along the Muskegon River numerous bays and inlets will make the development one of scenic attractiveness. The power company also announces that it will continue its reforestation program to beautify and develop the valley and plant millions of fish in an effort to restock the stream.

The power house will not be a part of the dam structure but will be built at about tailwater level at the downstream toe of the embankment. Steel conduits incased in concrete will carry water for the turbines and spillways from an intake tower of 45 ft. inside diameter and 125 ft. in height just upstream from the dam. This tower will rise above the lake level, with a one-story brick superstructure housing an operating room. In this superstructure will be the emergency-controlling mechanism for the gates and apparatus for cleaning racks or screens over the intakes. In all normal operation the gates will be remotely controlled from the power house. Work is scheduled to begin on the project this year and to be completed in 1931.

Sioux Falls Decides Against Expanding City Plant

By a vote of 7,054 to 2,400, the citizens of Sioux Falls, the largest city in South Dakota, refused on Tuesday to issue $100,000 in bonds for the enlargement of the municipal power plant. This is looked upon as a victory for the Northern States Power Company, which operates a competitive plant in Sioux Falls.

Accusations Against California Utilities

Testimony by State Senator Jones Before Federal Trade Commission Brings Out Allegation that $10,000 Was Paid to Labor Leaders to Influence Their Course

PERHAPS the most grave accusation yet made against any utility interest in the investigation by the Federal Trade Commission went into the record on Wednesday of this week when State Senator Herbert C. Jones of Santa Clara, Calif., chairman of the legislative committee that investigated the activities of the power companies of that state in combating the proposed state water-power act—thrice defeated on referendum—took the stand. Senator Jones testified that among other disbursements made by officials of power and light companies, as brought to light by the California committee, was $10,000 alleged to be for the purpose of influencing labor leaders after the State Federation of Labor had declared for the proposed legislation. No accounting was rendered for this money, Senator Jones said.

A certified copy of the investigation hearings was received by the Trade Commission last month. Senator Jones' testimony was to clear up points which were raised by this document. Campaign expenses against the measure amounted to $501,605, most of which came from power companies, it was brought out. The main barrage was laid down by the Greater California League in the northern part of the state and the People's Economy League in the southern, neither of which, the witness said, revealed before the election that it was formed and financed by utility support. The northern organization was headed by Eustace Cullinan, who was supplied with funds and had free rein. He worked through civic organizations and through subsidized individuals.

The half-million figure did not include the large expansion of business advertising which the power companies placed during the campaign, nor the alleged payment of $10,000 just referred to. Senator Jones stated, however, that his committee was unable to prove any effort to influence press opinion by this means. He mentioned that three out of five on the committee were opposed to the measure. The witness spoke of week-end excursions to plants and reservoirs, on which power companies invited prominent Californians as their guests, expenses paid. The inference was that this was a means of influencing opinion on the side of private ownership. The Senator was invited on two such trips, he said, but did not go.

Expenditures in support of the measure were $159,990, to which sum former United States senators were mentioned as heavy contributors.

When the commission's hearings were resumed on Tuesday, April 16, a mass of documentary evidence was introduced but no witnesses appeared. Among the exhibits marked for the record were

minutes of the executive committee of the Public Relations National Section, N.E.L.A., and excerpts from *Public Opinion*, a mimeographed service containing current press comment selected by the association. Minutes of the public speaking committee which were offered emphasized the growing trend of customer ownership of utility stock as an automatic guard against monopolistic tendencies.

The commission's interim report filed with the Senate last Monday says: "Examination of the books of account of certain holding companies was continued during the past month, and work is begun on one additional holding company in Chicago. Field work was continued on relations between utility groups and service organizations at the offices of important groups in New York City, Boston and Chicago." It will be a matter of months, however, before the findings are in shape for action. The Electric Bond & Share case is still pending before the New York District Court.

Following Wednesday's testimony the hearings were adjourned on call.

Inquiry Into New York Commission Law

Governor Roosevelt Signs Bill to Establish Body of Nine to Make Survey and Report Next Year—He Thinks Law Needs Great Amendment

DOUBT as to Governor Roosevelt's action on the bill passed by the New York Legislature at its recent session providing for a temporary commission to inquire into the working of the statute governing the New York Public Service Commission—not into any specific actions of the commission itself—was removed when on Tuesday of this week he affixed his signature to the measure.

As previously stated, the commission, which is to report back to the Legislature next year, will consist of nine members. Two of these will be (*ex officio*) the Speaker of the Assembly and the President pro tem. of the Senate—that is to say, Speaker McGinnies and Senator Knight, the two Republican leaders at Albany. The other seven will be appointed, three by the Governor, two by the Speaker and two by the Senator, and may or may not be members of the Legislature. Men of the caliber of former Governors Hughes, Miller and Smith have been suggested, but there is no certainty that any of the three just named would accept. The restricted nature of the inquiry is displeasing to some local bodies, like the City Club of New York and the Public Committee on Power in New York State, which wished the investigation to include the conduct of the Public Service Commission itself as distinct from the laws governing it. The Governor, in approving the bill, said:

> While I was hopeful that the Legislature would create a smaller commission for the purposes of making this survey, I am approving this bill in order to have the investigation started. I am convinced that the present Public Service Commission law is in need of great amendment, and I hope that this survey will be instrumental in recommending legislation to provide for a more efficient and just supervision and regulation of public service corporations and allied companies.
>
> Further, the whole principle of guaranteeing to the people a fair rate for the use of services provided by private corporations ought to be restudied. The theory of twenty years ago that the return to public service corporations should not exceed a fair profit on the money actually invested is constantly and flagrantly violated. Some method must be found to return to the original principle. There is an overwhelming demand for practical, definite and immediate action.

Secretary Good to Be Chairman of Power Commission

President Hoover has designated James W. Good, the Secretary of War, to be chairman of the Federal Power Commission. Under the water-power act the President must designate one of the three secretaries composing the commission as its chairman. In view of the fact that Secretary Wilbur of the Interior Department has had extended contact with the water-power situation, there had been some suggestion that the chairmanship of the new commission might go to him.

Attwill Denounces Press Attacks on "Power Trust"

Chairman Henry C. Attwill of the Massachusetts Department of Public Utilities strongly denounced sensational press attacks upon the power industry at a hearing on Wednesday before the legislative committee on ways and means at Boston, in connection with his advocacy of a bill to relax the present restrictions upon the entry of cities and towns into municipal ownership as a means of strengthening the regulatory powers of the commission. He declared that the way to control so called high financing in the utility field is so to regulate the local companies that it will be unprofitable for outside syndicates to buy their stock at tremendous prices and then pyramid other companies upon them and upon the local earnings. In support of the bill Mr. Attwill maintained that reasonable rates can be assured only through some form of contractual relationship between the operating companies and the state or else through public ownership.

Sheldon E. Wardwell, for the Massachusetts power companies, vigorously opposed the bill as a threat of political control, pointing out that it gives little protection to the investor, encourages agitation for municipal ownership and opens the door to dismemberment of plants without proper appeal to the courts.

Sentiment in the Massachusetts Senate is at present hostile to the bill, and little evidence has appeared of widespread popular interest in it.

Purchases and Mergers

Control of Fall River Company Goes to New England Power Association—Washington Water Power Company Buys Coeur d'Alene Utility

ROY F. WHITNEY, president and general manager of the Fall River (Mass.) Electric Light Company, announced on Wednesday that its majority stock has been acquired by the New England Power Association and Eastern Utilities Associates. Mr. Whitney said the management of the company would remain unchanged.

The Washington Water Power Company of Spokane, Wash., has just purchased the Kootenai Power Company of Cœur d'Alene, Idaho. Included in the transaction are the Consumers' Water Company and the Inland Sales Company, a merchandising firm, both also of Cœur d'Alene. The August Paulsen estate and others were the owners. The purchased properties approximate a valuation of $1,000,000.

The Central States Edison Company of Chicago announces that it has contracted to acquire the Bayfield Utilities Company, furnishing electric and water services to Bayfield, Wis., and surrounding territory; the Grand Marais Light & Power Company, supplying electrical energy to Grand Marais, Minn.; the municipal electric light plant at Liberty, Neb., and the electric distribution systems serving Rhineland, Loose Creek and McKittrick, Mo.

At Galt, Mo., the Missouri Public Service Company recently purchased the privately owned electric plant for $16,000. Advocates of a municipal plant contended that the price paid was too high, and on April 12 a vote of 243 to 7 was cast for a bond issue of $20,000 to construct a municipal plant.

The Western Public Service Company has purchased municipal plants at Madrid, Bloomington and Naponee, Neb.

The Long Lake Light, Heat & Power Company, supplying residents of the towns of Long Lake and Indian Lake, in Hamilton County, and Newcomb, in Essex County, has made application to the New York commission for permission to transfer its lines and franchises to the New York State Electric Corporation.

Authority has been granted by the California Railroad Commission to the California Telephone & Light Company to transfer to the Pacific Gas & Electric Company small public utility properties in Lake and Sonoma Counties.

A recent addition to the Canadian properties of the W. B. Foshay Company is the Sauble Falls Light & Power Company of Wiarton, Ontario.

The taxpayers of the International Settlement at Shanghai on Wednesday approved the sale of the electric power and light system of the settlement to the American & Foreign Power Company for approximately $50,000,000, according to cable reports.

In the States' Legislative Mills

Proposed Measures Which Affect Public Utilities Are Now Most Numerous in Wisconsin—Nebraska Has Been Good Second—Massachusetts Bills

TRUE to form, the Wisconsin Legislature has found in matters affecting public utilities one of its main fields for proposed statutes, and, late as it is in the session, a number of such bills still await its final action. Nebraska's Legislature, also much occupied with them, is on the eve of adjournment. Governor Roosevelt of New York has, as told under another heading, signed the measure providing a temporary body to "thoroughly study public service commission laws of this and other states to see if the law of this state accomplishes adequate state regulation and to determine what revisions, if any, are essential to safeguard the interests of the public, stockholders, bondholders and other creditors, and to draft any proposed legislation it may recommend."

ILLINOIS.—A bill which will require every public utility corporation to sell its products and service to municipal corporations when requested by the corporate authorities without discrimination as between private and municipal corporations has been introduced by Representative William Z. Black, Champaign, in the Illinois General Assembly and is now in the public utilities committee. The bill gives municipalities the right to contract for the service and products of utility corporations for purposes of resale and distribution to consumers within their corporate limits, and the municipalities are guaranteed the same rates and advantages for quantity use as are extended to private corporations and individuals.

Though a large number of utility bills have been introduced, very few have been acted upon in either branch. The Senate has passed a bill authorizing cities of not more than 30,000 population to sell public utilities owned by them and validating sales heretofore made. A House bill on third reading provides that the Illinois Commerce Commission shall within 90 days after the convening of the Assembly publish a statement of comparative public utility rates and furnish copies to the Governor and members of the Assembly.

MAINE.—One-half of the 4 per cent excise tax which, as reported last week, is to be imposed on exports of electricity, if the law just passed is ratified by the voters in September, is for ten years to be devoted to the construction of rural service facilities, within a maximum of $250,000 per annum. Former Governor Baxter, who strongly opposed the export bill introduced in his term of office, has declared himself in favor of the present one with the safeguards incorporated in it.

MASSACHUSETTS.—Two resolutions calling for utility investigations were filed in the House of Representatives this week—one by Representative Hagan of Somerville and the other by Representative McNulty of Boston. They provide for investigations of a more far-reaching order than asked in previous petitions, which have twice been rejected. There is some doubt as to the possibility of getting the new resolutions before the Legislature, but it is reasoned that they can be reached by suspending the rules. Mr. Hagan's calls for a committee of seven members of the Legislature to inquire into "foreign" investments in and control of Massachusetts corporations; also into holding companies, the N.E.L.A., the American Gas Association and the New England Bureau of Public Service Information. Mr. McNulty's calls for a committee of five members of the House to investigate the activities in Massachusetts "of certain paper and pulp manufacturing companies, power and light and other interests" and any propaganda emanating from them.

MINNESOTA.—Raising the levels of any waters in Minnesota which are a part of international boundary waters would be absolutely prohibited, with provisions that the state make armed resistance if necessary to any such efforts, under the terms of two bills introduced by Senator George H. Lommen of Eveleth. One object of the measures is, Senator Lommen admits, to "block the project of E. W. Backus, Minneapolis Imberman, to dam international waters to provide electrical power." The Backus interests supply energy to border communities.

The Senate has voted to recall from the House a bill which would permit a village to sell its light or waterworks plant on approval of five-eighths of the voters, instead of the two-thirds now required.

NEBRASKA.—The decision of the Legislature to adjourn *sine die* on April 20 forced a quick showdown in the House on the bills in committees and on the calendar that remained of the League of Municipalities' legislative program. Turbulent scenes marked one sitting, a league protagonist threatening to move to unseat the Speaker for partiality and a member of the House assaulting a lobbyist. Two of the bills passed by the Senate were killed. One provided that municipalities shall not sell utility or other property except for cash and another related to council action on franchise rights. Four other Senate bills were reported out of the House committee for indefinite postponement, but in three cases this was overruled and the bills placed on the calendar, although a majority of the House did not vote.

NEW YORK.—Governor Roosevelt has signed the Fearon bill, amending the Public Service Commission law by including a gas corporation, an electric corporation or a gas and electric corporation among the corporations which may acquire more than 10 per cent of the capital stock of any steam corporation.

TENNESSEE.—Although water-power legislation was scheduled for vigorous debate when the legislative session at Nashville started, the lawmakers have adjourned without passing any bill concerning it. Talk of an extra session is heard.

WISCONSIN.—By 65 to 27 the Assembly, after lively debate, last week passed the Reis bill eliminating the exemption from income tax now granted utility companies that operate street-car lines and adding light and power companies, along with telephone, railroad and insurance companies, to the income tax rolls. Mr. Reis claimed that the existing law was unfair inasmuch as 79 utilities pay income taxes while eighteen operate street railways, often at a loss, to avoid income taxes. The bill went to the Senate.

In addition, Assemblyman Reis introduced a bill allowing two or more municipalities and the intervening rural areas to form power districts for the purpose of acquiring electrical distribution facilities and operating them. This is one of the measures supported by the Wisconsin League of Municipalities.

A bill to require electrical utilities to keep separate accounts of their retail appliance business, if they conduct one, was introduced by Assemblyman E. M. Rowlands.

Assemblyman O. S. Loomis has introduced a motion to add three words, "except a municipality," to the law which specifies that when an electrical utility secures a franchise from the state to serve a certain territory no franchise for similar service shall be given to any other firm or individual. Mr. Loomis' motion would permit municipal plants to be established in places where private ones already existed.

The Assembly retracted the step it had taken to bar water-power development from the Menominee Indian reservation and turned the problem back to the Railroad Commission. This action affects the application from the Wisconsin Power & Light Company to build dams in Wolf River.

Two bills relating to municipal competition with public utilities have been offered in the upper house by Senator Duncan. The first allows municipalities to compete with public utilities, and the second allows the formation of power districts between municipalities for competitive purposes, in line with the Reis measure already mentioned. Senator Duncan also has a joint resolution to instruct the Railroad Commission to hold an investigation with the object of instituting uniform rates for electricity in the state.

By the margin of one vote, the special interim water-power committee went on record as favoring a constitu-

tional amendment to authorize the state to take over water-power sites and dams at the end of 30 years and go into the business of generating and selling electrical energy.

Protest Against Niagara Falls Power Treaty

A letter sent to Senator Robert F. Wagner of New York by the Public Committee on Power, which has been an active agitator in that commonwealth, cites eleven objections to the proposed treaty with Canada over Niagara Falls permitting further diversion of their waters. (See ELECTRICAL WORLD for January 5, page 65.) Ten refer to alleged danger to the interests of the state and to conflict with Governor Roosevelt's water-power development plans.

The letter, signed by Arthur Garfield Hayes, demands the substitution of the State of New York for the Niagara Falls Power Company as the agent of the federal government.

The eleventh objection declares that an alleged defiance by the company of orders of the federal government furnishes an additional reason why it should not be made the government's agent. The letter estimates the value of the proposed grant to the company at $62,000,000 and the return in rentals to the state at between $37,750 and $68,250 annually.

Program of Hot Springs (Ark.) Joint Meeting

At the joint meeting of the Southwestern Geographic Division of the N.E.L.A. and the Arkansas Utilities Association at Hot Springs, Ark., April 30-May 3, there will be general, accounting, commercial, engineering and public relations sessions, as well as a public policy meeting on the second night. At the latter H. B. Flowers of New Orleans will preside and Vice-President Charles W. Appleton of the General Electric Company will make an address. The opening meeting, on Tuesday afternoon, will be devoted to a discussion of advertising and publicity to which Beeman Fisher of Dallas, B. E. Eaton of Gulfport, Miss., and George F. Oxley of N.E.L.A. headquarters will contribute papers, while J. F. Owens and Leonard Nelson of Oklahoma City, A. G. Whidden of Pine Bluff, Ark., and H. B. Flowers will participate in the discussions.

Among those who will take part in the general sessions are Presidents J. G. Holtzclaw of the Southwestern association, W. E. Bann of the Arkansas Utilities Association and P. S. Arkwright of the N.E.L.A.; Paul S. Clapp, managing director N.E.L.A.; Frank L. Blanchard of H. L. Doherty & Company, J. F. Owens, E. H. Sniffen of the Westinghouse company, W. J. Hagenah of the Byllesby company and Labert St. Clair of the A.E.R.A.

Commercial Director C. E. Greenwood of the N.E.L.A., W. A. Darden, Oklahoma City, and others will address the Commercial Section; L. W. W. Morrow, editor ELECTRICAL WORLD, and C. J. Rutland, Dallas, the Engineering Section; R. C. Coffy of Fort Smith, E. E. Armstrong of Gulfport, H. M. Blain of New Orleans and Ruth P. Steinhauser of Fort Worth the Public Relations Section. There will be a women's committee meeting addressed by six public utility company women and a joint meeting of the Public Relations Section and the women's committee addressed by E. F. McKay of Oklahoma City, Miss F. D. Schertz and others. In addition, the section chairmen will be heard at Wednesday's general sessions and the chairmen of more than a score of committees will report at the appropriate sectional meetings. Entertainment will be well taken care of.

Skagit Project Needs Fund of $13,500,000

Bond Issue in That Sum Before Seattle Council — Hanging Rock Dam and Million-Dollar Tunnel Included in Estimate—Case Defends Department

AN ORDINANCE proposing a bond issue of $13,500,000 for a dam at Hanging Rock on the Skagit hydro-electric project and to provide payment for other developments has been introduced in the Seattle City Council. Diablo Dam, part of the Skagit project, is now under construction and will be completed early next spring. Included in the project is the building of the Diablo power house with a rating of 90,000 kw. The new program includes the Hanging Rock dam, extension of the tunnel from the Gorge intake to the dam, building of a transmission line to Seattle and repayment of several million dollars for construction work advanced from current revenues.

Plans for the tunnel, about 2,000 ft. long, to carry water from the new Diablo Dam to the power-house site at Reflector Bar have been approved by the Board of Public Works and are now ready for consideration by the Council. Construction work on the bore and power-plant penstock is expected to start on the Council's order soon. Plans call for a concrete tunnel, 19 ft. 6 in. in diameter, considerably larger than the one serving the Gorge Creek plant. The engineers' cost estimate of $1,000,000 covers building of the penstock from the lower end of the bore into the power house.

Installation of the third unit of electrical generating equipment has just been completed at the Gorge plant. It is capable of producing 33,000 kw. and brings the rated capacity of the plant to 93,000 kw., but it cannot be operated to this capacity until the Diablo Dam is completed.

In defense of the Seattle Light Department, soon to be subjected to an efficiency survey along with other city departments in an effort at greater economy and better management, Councilman Otto A. Case declares that Seattle stands third in a list of large American cities in point of low light and power rates, and he declares that rates will continue to fall as new municipal developments are perfected. If the average schedule obtaining over the country were to be charged in Seattle, Mr. Case says, the people of the city would be paying $9,000,000 more a year for light and power than they now are. He also maintains that Seattle housewives have a greater number of electric ranges and other electrical appliances in use in proportion to the population than are found in any other city of the country.

Wisconsin Utilities Dispute League's Figures

Comparative rates of private and municipal power and light companies, filed by Carl D. Thompson, secretary of the Wisconsin League of Municipalities, with the Legislature's interim committee on water power are "inaccurate, meaningless and unfair," according to a brief filed recently by the Wisconsin Utilities Association. The league rates purported to show the municipal light and power rates to be less than those of private companies.

G. C. Neff, vice-president of the Wisconsin Power & Light Company, Madison, who filed the brief for the private utilities, said the rates quoted by the league in 37 cities and 63 villages are incorrect and misleading. The association presented the following table against the "more flagrant league errors":

Town or City	Kw.-Hr. Used	Bill Shown by League	Bill Shown by Utilities
Alma	43	$5.75	$4.21
Appleton	26	2.59	2.16
Fort Atkinson	91	5.67	4.13
Milwaukee	55	4.25	2.59
Mondovi	26	3.96	2.88
Racine	54	3.58	2.70
Stanley	29	4.06	3.15
Waukesha	44	4.80	2.54
West Allis	48	3.19	2.39

"Private company rates are lower than cited by the league in 33 cities and higher in four cities," the brief said. "In the tabulation of village rates the league's table of rates of private companies is higher than they actually are in 51 villages and lower in twelve.

"A striking example of the inaccuracy of the league's statistics is found in figures for Milwaukee service. According to the league, a consumption of 55 kw.-hr. would cost $4.25. The average residence customer in Milwaukee, even if he paid for all his consumption at the top rate of 7 cents per kilowatt-hour, would pay only $3.66. In the average home the bill for 55 kw.-hr. would be only $2.59, or $1.66 less than the league claims, because the average customer pays only 3 cents per kilowatt-hour for all energy in excess of 27 kw.-hr.

"Inspection of the statistical tables submitted by the league shows they are incorrect to such an extent that they are unworthy of consideration. Some of the comparisons with cities outside of the state are also improper and unfair."

Maryland Men Talk on Public Relations

Their Basis and the Policies Involved Form Chief Topic of Utilities Association Meeting—Business Conditions Canvassed Also

BETTER public relations and concomitant problems dominated the deliberations of the electric group at the seventh annual convention of the Maryland Utilities Association, held in Baltimore on April 12. F. F. Hennaman of the Penn Central Light & Power Company and H. S. Metcalfe of the West Penn Power Company discussed the general basis and policies involved, while R. F. Bonsall, C. H. Leatham and G. P. Mangan offered practical observations for achieving the desired results through the activities of the operating personnel. The electric, transportation, gas and water groups met separately in the morning and jointly in the afternoon.

Paul Wooton, Washington correspondent of the ELECTRICAL WORLD, outlined general business conditions and the probable trend of Federal Reserve Board activities, copper price and industry developments, influence of electrical energy upon economic conditions in the coal-mining industry and related topics at the afternoon session. A. C. Roy of the Edison Lamp Works presented an inspirational sales talk on "Retail Merchandising" and pointed out some often-overlooked possibilities. "The Place of the Public Utility Under Modern Business Conditions" was noted by M. B. Lambert of the Westinghouse Electric & Manufacturing Company, with particular reference to the railway field. "Televox," the mechanical man, was demonstrated.

At the closing session following the banquet, at which Governor Albert C. Ritchie was among the guests, the Governor advocated better and more intimate relations between the utility and those served, pointing out the need for the education of the public.

President H. T. Connolly presided. The officers elected for the coming year are: President, H. A. Brooks, Potomac Electric Power Company; vice-president, R. E. Towne, Potomac Edison Company; treasurer, Frank E. Mitchell, Eastern Shore Gas & Electric Company; secretary, David Kennear, United Railways & Electric Company. L. G. Smith, Consolidated Gas, Electric Light & Power Company, is chairman of the electric group. Nearly three hundred members and guests registered for the business sessions and many more attended the banquet.

Electricity Topic at Meeting of Oil-Burner Men

"Automatic oil heat and electricity are so closely associated with each other that the spirit of co-operation between the two must be continued without interruption, in order that their mutual problems may meet with successful solution," said George F. Oxley, director of the department of public information, N.E.L.A., in an address before the sixth annual convention of the American Oil Burner Association, held in New York City on April 9, 10 and 11. The nineteen million wired homes of the United States are the oil-burner industry's potential market, he said. Mr. Oxley took the place of Matthew S. Sloan, president New York Edison Company, who was unable to attend. Close to two thousand officials and delegates of the oil-burner industry, the oil industry, the electrical industry and other allied industries attended the convention.

The American electrical industry was adequately represented in the exposition of the convention, which occupied two floors of the Hotel Pennsylvania. A large number of newly developed electrical accessories to oil heat were on display. One of the discussions related to the electrical industry was led by Elliott Harrington, industrial engineer of the General Electric Company, who touched on various elements in which the electrical engineer is interested, including electrical ignition and the problem of spark interference with radio. "With relation to these problems," Mr. Harrington said, "standardization practice cannot be applied, but each combination must be worked out as an individual problem." He described the studies being made of the application of electric heat elements for ignition and declared that the maintenance of the element above 1,750 deg. F. would provide satisfactory ignition for virtually every oil burner.

Forty Million Dollars from Electrical Advertising

Hand in hand with the many new load factors being developed by the electric light and power industry is electrical advertising, which now is producing an annual revenue for central stations of approximately $40,000,000, according to a survey now under way by W. J. Moore, supervisor of the electrical advertising section of the Society for Electrical Development. Tentative estimates, he said, show a total expenditure by business of close to $70,000,000 annually in this form of advertising.

With this volume of business coming in, Mr. Moore pointed out that there has been a consequent reduction in the cost of selling this load to the consumer per dollar of revenue added by the central station. In 1922 it cost a central station in a city of only 90,000 population 59 cents for each dollar of added revenue, while in 1928 it cost only 7.2 cents in the same city, there being a consistent decline year by year through the entire period due to the cumulative effect of a continuous sales effort.

Despite this large volume of business and descending costs, the market for this medium has only been dented, Mr. Moore says. The potential field will yield at least $300,000,000 annually, of which $200,000,000 would represent the income to the utilities. The population of any given territory multiplied by $1.50 about equals the potential annual revenue that any central-station company can derive from the electrical advertising load. In one typical instance investigated, $134,000 was added to a central station's income with only two salesmen in the field. "One illuminated painted bulletin," Mr. Moore is convinced, "is equivalent to one-half mile of highway lighting in annual revenue."

How the Consumers Power Company Met Storm

Storms and floods that swept Michigan early this month put interconnected power lines to a severe test that abundantly proved their value. By their means service was kept going to dozens of Michigan communities that otherwise would have been without electricity in whole or part. Terrific gales on April 1 were accompanied by sleet in the northern and western parts of the state. The sleet coated the transmission lines thick with ice. This increased wind resistance, and the strain on the wires, already extraordinary, became so great that there were a number of breaks.

Consumers Power Company lines went down between dams on the Manistee and Muskegon Rivers and Muskegon, Grand Rapids and other western Michigan towns and between the dams on the Au Sable River and cities in eastern and central Michigan. This cut off the flow of hydro-electric power from the northern rivers. At once the reserve steam turbines at Grand Rapids, Zilwaukee and other points went into commission to restore the load and spread it through interconnecting transmission lines to the entire Consumers Power system. At the same time the system began to draw automatically upon the reserves of the Detroit Edison Company through the interconnecting line between the two systems. At one time during the emergency this line carried a load of 45,000 hp. from the Detroit Edison to help the steam-turbine plants of the Consumers Power make up for the temporarily lost water power. The same reserves were called upon in lesser degree later in the week when torrential rains turned the Tittabawassee River and its tributaries into raging floods.

Several weeks ago, when Detroit experienced its "dark day," the reserves of the Consumers Power Company were called upon to help the Detroit company carry an extraordinary peak load. Fog and smoke conditions on the "dark day" turned day into night, superimposing the usual evening lighting load upon the regular daytime industrial load. The "dark" conditions existed only in the Detroit area, so Consumers Power was in a position to lend all the current Detroit Edison needed in that emergency.

Briefer News

INDIANA PUBLIC UTILITIES ASSOCIATION TO MEET IN MAY.—The annual conventions of the Indiana Electric Light Association and the Indiana Public Utilities Association are to be held at the Hotel Gary, Gary, on May 2 and 3. May 2 will be given over to general utility subjects. The program for May 3 will be in charge of the Indiana Electric Light Association. Speakers of national prominence are scheduled.

NEW MUNICIPAL PLANT FOR JACKSON, TENN. — A measure enabling the city of Jackson, Tenn., to issue $1,000,000 in bonds for the construction of municipal electric and gas plants has passed the Tennessee Legislature. Jackson has now a small municipal plant, but its chief source of energy is the Jackson Railway & Light Company, subsidiary of the National Power & Light Company.

NEW TRANSMISSION LINES FOR CENTRAL ILLINOIS PUBLIC SERVICE.—The Illinois Commerce Commission has authorized the Central Illinois Public Service Company to construct transmission lines from Athens to Cantrall, from Farina to St. Peter and from Mattoon to Larna, as well as to operate the property of the Prairie Electric Company at Stewardson and Strassburg.

A.S.C.E. JOINS AMERICAN ENGINEERING COUNCIL.—The American Society of Civil Engineers has been admitted to membership in the American Engineering Council. The A.S.C.E. has a membership of 13,577. In joining the A.E.C. it becomes associated with six other national engineering societies—the A.I.E.E., the A.S.M.E. and the associations of chemical, consulting, agricultural and industrial engineers.

SOUTHERN COLORADO POWER COMPANY PLANS EXPENDITURE OF $275,000. —In extending, improving and repairing its system the Southern Colorado Power Company of Pueblo plans to spend this year $275,000. Increased use of appliances in the residential districts of Pueblo, additions in the business district, electrification of farms and the use of electrically driven pumps for irrigation are the chief sources of fresh demand.

REDUCTION OF COMMERCIAL RATES SOUGHT IN GEORGIA.—The Georgia Public Service Commission last week opened an investigation of commercial light and power rates in 160 cities served by the Georgia Power Company. Several hundred petitions asking for a reduction had been received by the commission. Atlanta, Milledgeville, Dublin and other cities were directly represented. President Arkwright of the company, admitting that there are 23 separate scales, protested against any hasty readjustment and declared that a proposed plan of putting commercial light and power rates on the same rate schedule as residences would cut the commercial revenues of the company more than $1,375,000, or 45.1 per cent, which no company could stand.

MUNICIPAL ELECTRIC PLANT FOR MOBILE AGITATED. — Agitation for the erection of a municipal power plant in Mobile as an operating adjunct of the waterworks system, a city-owned property, has advanced another lap. Commissioner Hartwell, in charge of waterworks, has been authorized to instruct the city attorney to prepare an ordinance which, if adopted by the City Commission, would have the effect of calling a special election to submit a waterworks bond issue of $1,000,000 to finance the project.

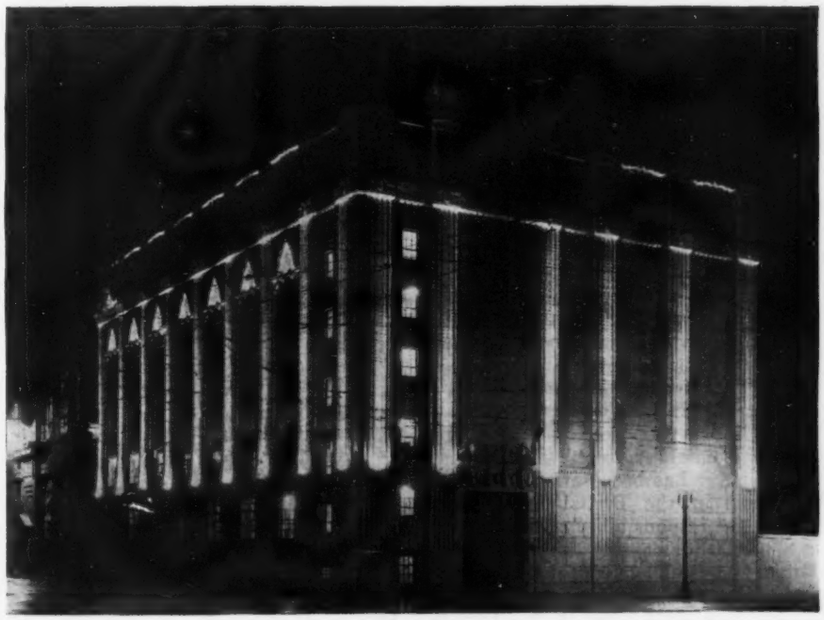
YOUNG AUSTRALIA VISITS EDISON LIGHTING INSTITUTE.—A group of 160 youths from various parts of Australia and New Zealand, sent by the Young Australia League for the purpose of increasing good will between the two continents and of obtaining an insight into American home, educational and industrial life, were guests recently of the Edison Lighting Institute at Harrison, N. J. The visit, which was arranged through W. C. Duncan of the International General Electric Company, included a trip to the bulb works and lamp factories, where the boys, whose average age is seventeen, witnessed the lamp-making machinery in actual process of operation. The young visitors toured California and visited San Antonio, Chattanooga, Washington, New York, West Point, New Haven, Boston, Halifax, Quebec, Montreal and Vancouver.

LOS ANGELES GAS & ELECTRIC IS BUILDING NEW SUBSTATION.—Work begun in February by the Los Angeles Gas & Electric Corporation on the erection of substation No. 8, at Tenth and Hobart Streets, to cost more than $200,000, is progressing. The new substation will have a capacity of 15,000 kva., which is three times that of an older station at the same location. It will be under supervisory control from substation No. 14, on South Coronado Street. The new plant is expected to be in operation by fall.

NEW ENGLAND N.E.L.A. ELECTS OFFICERS.—Charles H. Hodskinson of the Boston Edison company was elected president of the New England Division of the N.E.L.A. at the annual meeting in Boston last week, to take office July 1. Other officers chosen were: Vice-presidents, H. E. Duren, Greenfield, Mass., and W. C. Bell, New England Power Association, Boston; treasurer, Frank L. Ball, Charles H. Tenney & Company, Boston. The next convention will be at the Hotel Griswold, New London, Conn., Sept. 9-12.

PROGRESS ON DEVIL'S RIVER PLANTS IN TEXAS.—Work is nearing completion on the hydro-electric generating plant at Lake Walk, project No. 2 in the Central Power & Light Company's development of water power on Devil's

Station B Extension Fits San Diego Surroundings



TO SAY that a building fits its surroundings in San Diego is to say that it is architecturally attractive, for California's southernmost center of population is noted for structural as well as natural beauty. Station B extension, belonging to the San Diego Consolidated Gas & Electric Company, is on the point of completion at the foot of the city's most important street, where its Spanish style is in harmony with surrounding buildings. It contains a new 28,000-kw. turbo-generator and much other equipment.

River in Texas. The dam and power house at Lake Walk are more than 90 per cent complete, and at the present rate of construction the plant may go into operation about the first of May. All construction work on the Devil's Lake hydro plant, near Del Rio, was finished during the second week of March. This plant has been under operation since last December and now is running under a full head of 47 ft.

KENTUCKY COMPANY BUILDS LINE TO JEFFERSON DAVIS MONUMENT.—Lack of power to operate the passenger elevator in the Jefferson Davis Monument at Fairview, Ky.—one of the highest of its kind in the country—has proved hitherto a drawback from the sightseer's point of view. This lack has been remedied by the Kentucky-Tennessee Light & Power Company of Bowling Green, Ky., which has built a line from its generating plant at Hopkinsville to Fairview to make power for this purpose available. Completion of the line is expected on April 20. Citizens contributed almost a third of the expense, the rest being borne by the company.

MUNICIPAL PLANT OF TAUNTON, MASS., OFFERS CITY $100,000 AS GIFT.—The Taunton (Mass.) Municipal Lighting Plant has offered the city of Taunton $100,000 from its operating fund as a gift to be used as the Mayor and the City Council deem best. The Municipal company, organized in 1897, purchased its plant for $125,000, has operated on a profitable basis since 1919 and is now valued at $2,200,000. There is some question regarding the legality of such a gift. If finally pronounced legal, the money will be used toward the construction of an addition to the Taunton High School to cost $200,000. In the past year the municipal plant reported revenues of $610,000 and a gross operating profit of $181,000. Lighting rates are 8 cents a kilowatt-hour for domestic use and range down to 1.75 cents for large power consumers.

ONCE MORE THE FISH QUESTION.—Strenuous objection has been made on behalf of the fish industry to the issuance of a new license to the Washington Irrigation & Development Company under the same conditions as applied on the original license, the period of which expired March 1. The development involved is that proposed at Priest Rapids on the Columbia River. The fish industry never has been satisfied with the provision in the first license, which limited the responsibility of the company to $300,000 for passing the fish over the dam or the establishment of a fish hatchery. The fear is expressed that this amount will not be adequate to establish a hatchery or to construct the necessary works to enable the fish to get by the obstruction. Power specialists are of the opinion, however, that no great difficulties are involved in protecting the fish under the conditions of the license. No action on the new application can be had until the Federal Power Commission formally terminates the existing license. While the period of the license expired on March 1, it continues in effect until formally terminated by the commission.

WESTINGHOUSE LIGHTING INSTITUTE OPEN TO PUBLIC FIRST OF JUNE.—The date for the public opening of the Westinghouse Lighting Institute, which, as announced last week (page 752), the Westinghouse Lamp Company is about to establish in the Grand Central Palace, Lexington Avenue and Forty-sixth Street, New York City, has been fixed to coincide with the opening of the N.E.L.A. convention and exhibition on May 31, so that delegates on their way to and from Atlantic City will have an opportunity to visit the new concern. Work has progressed so rapidly, however, that specially invited guests will be able to see the institute in the latter part of May. Building alterations are virtually complete and the electric installations are well started.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

American Welding Society—Engineering Societies Bldg., New York, April 22-26. M. M. Kelly, 29 West 39th St., New York.

Middle West Division, N.E.L.A.—Hotel Fontenelle, Omaha, Neb., April 24-26. T. A. Browne, Lincoln, Neb.

Southwestern Division, N.E.L.A. — Arlington Hotel, Hot Springs, Ark., April 30-May 3. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.

Arkansas Utilities Association — Arlington Hotel, Hot Springs, Ark., April 30-May 3. R. I. Brown, Arkansas Power & Light Co., Little Rock, Ark.

Indiana Electric Light Association — Hotel Gary, Gary, Ind., May 1-3. William Stokes, 1548 Consolidated Bldg., Indianapolis, Ind.

American Institute of Electrical Engineers—Regional meeting, Dallas, Tex., May 7-9; summer convention, Swampscott, Mass., June 24-28. F. L. Hutchinson, 33 West 39th St., New York.

East Central Division, N.E.L.A. — Louisville, Ky., May 7-10. D. L. Gaskill, Greenville, Ohio.

Southeastern Division, N.E.L.A.—Asheville, N. C., May 8-10. C. M. Kilian, 207 Bona Allen Bldg., Atlanta.

Missouri Association of Public Utilities —Bothwell Hotel, Sedalia, May 16-18. F. D. Beardslee, 315 N. 12th St., St. Louis.

National Electrical Credit Association —Statler Hotel, St. Louis, May 16 and 17. F. P. Vose, 1008 Marquette Bldg., Chicago.

National Electrical Manufacturers' Association — The Homestead, Hot Springs, Va., May 20-25. S. N. Clarkson, 420 Lexington Ave., New York.

American Electrochemical Society—Toronto, May 27-29. C. G. Fink, Columbia University, New York.

National Electrical Wholesalers' Association—The Homestead, Hot Springs, Va., May 27-31. E. Donald Tolles, 165 Broadway, New York.

National Electric Light Association—Atlantic City, N. J., June 3-7. A. J. Marshall, 420 Lexington Ave., New York.

North Central Electric Association—Breezy Point, Pequot, Minn., June 16-18. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Association of Iron and Steel Electrical Engineers—Pittsburgh, June 17-21. J. F. Kelly, 1007 Empire Bldg., Pittsburgh.

Canadian Electrical Association — Algonquin Hotel, St. Andrew's by the Sea, N. B., June 19-21. H. M. Lyster, 712 Power Bldg., Montreal.

Pacific Coast Electrical Association—Del Monte, Calif., June 19-22. S. H. Taylor, 447 Sutter St., San Francisco.

Society for the Promotion of Engineering Education—Ohio State University, Columbus, June 19-22. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Northwest Electric Light and Power Association—Seattle, June 26-29. B. Snow, 1206 Spalding Bldg., Portland, Ore.

EL PASO COMPANY STARTS CONSTRUCTION ON NEW MEXICO LINE.—Construction has been started by the El Paso Electric Company on a 22,000-volt transmission line from Las Cruces, N. M., to Hatch, N. M. This 43-mile extension will be carried on 45-ft. poles.

VIRGINIA POLYTECHNIC TO INAUGURATE RURAL ELECTRIFICATION SHORT COURSE.—The first short course on rural electrification to be given by any university in the Southeast will be at the Virginia Polytechnic Institute at Blacksburg, Va., on June 12, 13 and 14. The tentative program contains the names of such authorities as G. C. Neff, L. C. Prickett, W. C. Brown, G. W. Kable and others, as well as the professors of the agricultural engineering department of the institute, of which department Prof. Charles E. Seitz is the head. A good attendance from Virginia is assured, and power companies in adjoining states also are expected to be well represented.

"ELECTRIC LEAGUE DAY" AT INDIANAPOLIS.—April 8 was an outstanding day at the Indianapolis Home Show, an affair that attracts approximately 150,000 visitors annually. On the day mentioned the Electric League of the city was in part charge, furnishing entertainment, a home-lighting demonstration by T. P. Brown of the Edison Lamp Works, a "Televox" performance by courtesy of the Westinghouse company and other features. In the latter part of March the Indianapolis Electric League sponsored an illumination conference under the auspices of the Westinghouse, Edison and National lamp works. Builders, architects, electrical engineers, maintenance men and league members to the number of sixty or seventy attended each of six sessions.

HALT IS CALLED ON RAQUETTE RIVER PROJECT IN NORTHERN NEW YORK.—The Northeastern Power Corporation, of which Floyd L. Carlisle of Watertown and New York is president, on April 10 suspended all operations on the South Colton power development on the Raquette River in St. Lawrence County. Workmen who had recently started operations were dismissed. The reason for the abandonment of the project, which had been said to contain possibilities of becoming one of the largest hydro-electric developments in northern New York, has not been divulged by the company officials, but "sufficient business and engineering

reasons" are said to explain the change of plan. In place of the South Colton development, the Northeastern Power Corporation is expected to take up others, perhaps on the Oswegatchie.

CANADIAN EXPORTATION OF ENERGY TO UNITED STATES INCREASES.—A general increase in exports of electrical energy from Canada to the United States during the last three years was shown in a statement tabled in the Canadian Parliament recently by the Minister of Trade and Commerce. The report showed that in 1926 1,281.8 hp. was exported from New Brunswick, 54,240.8 hp. from Quebec, 171,887.3 hp. from Ontario, and 2,878.6 hp. from British Columbia. In 1927 the exportation of electrical energy from New Brunswick was 1,485.9 hp.; from Quebec, 59,818 hp.; from Ontario, 188,175 hp., and from British Columbia, 320.8 hp. In 1928 1,833.8 hp. was exported from New Brunswick, 60,702.8 hp. from Quebec, 178,637.7 hp. from Ontario, and 251.8 hp. from British Columbia.

COLORADO TO HAVE STATE-WIDE ELECTRICAL MEETING NEXT WEEK.—The fourth annual state-wide meeting of Colorado electrical men will be held in Denver Wednesday, April 24. Its principal features include the extension of league territory to embrace the entire state for operation of the "red seal" wiring plan.

MORE POWER FOR MINING REGION IN NORTH ONTARIO.—Increasing demand for electrical energy in the mining districts of northern Ontario is apparent from the statement made by A. J. Nesbitt, president of the Canada Northern Power Company, that a lease for the development of power at "the Notch," on the Montreal River, south of Cobalt, has been obtained from the Ontario government and that preliminary investigations have been under way at this site, where approximately 45,000 hp. may be eventually developed.

DALLAS ACCEPTS POWER COMPANY'S BID FOR ENERGY FOR MUNICIPAL PUMPS.—Settlement of a protracted controversy between members of the City Commission of Dallas as to whether electric power shall be used for all pumping equipment of the municipal waterworks has been reached by the acceptance of the proposal of the Dallas Power & Light Company (ELECTRICAL WORLD, March 30, page 655). It is agreed that the levee district may connect its water pumps to the same circuit, paying the city the rate to be charged by the power company. The agreement provides for a five-year contract, with an option for an additional five years at the same rates, which are as follows: $1.50 net, or $1.58 gross, per month per kilovolt-ampere of maximum demand; 1 cent net, or 1.05 cents gross, per kilowatt-hour for the first 175,000 kw.-hr. per month; 0.6 cent net, or 0.63 cent gross, for each kilowatt-hour in excess of 175,000 kw.-hr.

Recent Court Decisions

NORTH DAKOTA COMMISSION DIVESTED OF POWER TO INCREASE CONTRACT RATES.—Requirements imposed upon electric light companies by franchise agreements may not be abrogated by an order of the North Dakota Board of Railroad Commissioners. This decision was made on April 10 by the Supreme Court of the state in a case of far-reaching importance in interpreting the state public utility law. The Chrysler Light & Power Company sought to force the city of Belfield to pay for electrical energy used in municipal lighting on the basis of a rate fixed by the board. Rates for this service were incorporated in the franchise permitting the company to do business in Belfield. After several years of operation the franchise was amended to raise the rates. In 1921 the company appealed to the Railroad Board to fix a rate for street-lighting service, and the board made a ruling granting a still further increase. The city paid the rate fixed by the state body from May, 1921, to January, 1927, and then refused to pay more than the contract rate established in the franchise. The Supreme Court's decision affirms that of the county district court from which it was appealed. The court held that the board's order increasing the street-lighting rate was void, but that Belfield was not entitled to collect $887 as a refund for overpayment since 1921, as it had made the payments voluntarily.

DAMAGE TO LAND OUTSIDE RIGHT-OF-WAY MUST BE PROXIMATE AND DIRECT TO WARRANT RECOVERY.—The Illinois Supreme Court held, in East St. Louis Light & Power Company vs. Cohen, that recovery for alleged damage to land outside two tracts taken for high-tension towers, with a 66-ft. easement between them, must be based on actual present injury and that the owners had the burden of proving such damages. "Appellants complain that no damage was allowed for land not taken outside of the 66-ft. strip," said the court. "This land was not described in the petition. The claim for damage to it was set up in a cross-petition by appellants, and the burden was upon them to prove this damage. The evidence must show that there will be some proximate and direct physical disturbance of property or a right of property, by reason of which damage results in excess of that sustained by the general public. Opinions of witnesses must be based upon elements of damage which are recognized in law as proper to be considered. The mere fear of a remote and contingent injury which may never occur and whose happening is speculative and uncertain is not a proper element of damage. The damage allowed must be direct and proximate." (164 N. E. 182.)*

MAYOR OF SAC CITY, IOWA, GUILTY OF DERELICTION IN NOT CALLING FRANCHISE ELECTION.—A decision was handed down by the Iowa Supreme Court some weeks ago relating to the supply of electricity in Sac City, the contest between the city authorities and the Iowa Public Service Company at which place has occasionally been mentioned in the ELECTRICAL WORLD. Seventy-five residents of Sac City filed a petition with Mayor Tourgee to call a special election on the granting of an electric franchise to the company. Subsequently, in the fall of 1927, the company requested the Mayor and City Council to submit the question to the electorate. The Mayor and members of the Council attempted to procure withdrawals from the petition. The company then prepared a new instrument, procured the necessary signatures and presented the same to the city officials. Once more the Mayor refused to determine the sufficiency of the petition and again personally and by organization with others attempted to induce withdrawals. On February 2, 1928, the company brought action for mandamus against the Mayor to compel the calling of a special election on the franchise. In reversing the action of the District Court, which denied the mandamus, the Supreme Court held that the failure of the Mayor to call an election was an omission of a duty resulting from his office. (222 N.W.882.)

MUNICIPALITY PAYS $10,000 BECAUSE OF NEGLIGENCE IN OPERATING DISTRIBUTION SYSTEM.—Confessing its negligence in not properly insulating its guy wires, the city of Seward, Neb., which operates a distribution system, has caused the dismissal of its appeal to the Supreme Court from a judgment for $10,000 rendered in favor of the legal representatives of Lawrence Allay, a ten-year-old boy permanently maimed by contact with the wires.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

IN CONSOLIDATION CASES JUDGMENT OF COMPANIES CONCERNED SHOULD BE RESPECTED.—The Maine Public Service Commission does not think it part of its duties to insist that positive gains to the public from consolidations be established before the regulating body shall consent to them. In a merger case affecting the Ashland Electric Light & Power Company it said: "The petitioners represent that the union of the various companies into one organization would result in desirable economies and could in no way be inimical to the public interests. Such mergers have been before this commission on numerous occasions, and we recognize that in the absence of reasons impelling us to a contrary view, we should respect the judgment of those who own and control such properties."

UNPROFITABLE SERVICE CANNOT BE FORCED ON UTILITY.—In denying a petition of certain citizens in Chaffee and Embden, N. D., for electric service from the transmission line of the Otter Tail Power Company, the Board of Railroad Commissioners of North Dakota said: "If the only question involved in this proceeding was as to whether public convenience and necessity would be subserved by the extension of the Otter Tail Power Company's transmission line to these villages, our task would be easy, for there is no question but that the villages are not now being adequately served. However, the board must further take into consideration, among other matters, the amount of revenue likely to be derived therefrom and the prospect of a reasonable return to the utility upon the value of the extension, and the commission is further charged with the duty of fixing reasonable rates for such service."

News About Men of the Industry

Charles Hodskinson Heads New England Division

Charles H. Hodskinson, president-elect of the New England division, N.E.L.A., was born at Salem, Mass., in 1874 and was educated in the public schools of that city. In 1892 he entered the employ of the Boston Edison Company as an office boy. After filling various positions he was transferred in 1902 to a clerkship in the executive offices to take up various duties under the direction of President C. L. Edgar. He gradually rose to the position of superintendent of the statistical department of the executive offices, and in 1916 was made a bureau officer of the company in charge of statistics.

Mr. Hodskinson's activities have always covered a broad field in the public utility industry. As a result of a recommendation by him to President Edgar in 1909, a movement was started which led to the organization of the New England Geographic Section of the National Electric Light Association, and much of the pioneer work of the section was carried out by him under Mr. Edgar's direction. This was the first geographic section of the association to be organized in the country and Mr. Hodskinson was its first secretary and treasurer. He has served on several committees of the National Electric Light Association and for three years was its master of transportation, having charge of all transportation to the St. Louis, New York and Seattle conventions. He has been for many years secretary and treasurer of the Massachusetts Electric and Gas Association. He has also served as chairman of the Boston section, American Institute of Electrical Engineers. He was treasurer for three years of the New England Bureau of Public Service Information following its organization in 1921.

NEWELL A. CLARK has been appointed assistant general manager of the Narragansett Electric Company, Providence, R. I., instead of assistant to the general manager, as announced in the ELECTRICAL WORLD April 13, 1929.

M. A. MILLER, formerly assistant secretary and assistant treasurer of the Penn Central Light & Power Company, has been elected secretary-treasurer of that utility. Mr. Miller became auditor of the company in 1910, when it was acquired by Day & Zimmermann. He was promoted to the position of comptroller in 1923. When the property passed under the control of the National Electric Power Company in 1925 he was promoted to the position of assistant treasurer and assistant secretary. In 1927 he was elected a member of the board of directors. He is also a member of boards of directors and secretary and treasurer of other associated railway and electric light and power companies. He has been active in the N.E.L.A., serving on various committees. He was also chairman of the accounting section of the Pennsylvania Electric Association during 1927.

GEORGE M. KEENAN, chief system operator of the Pennsylvania Power & Light Company, has been appointed manager of the Pennsylvania-New Jersey interconnection. Mr. Keenan is in the joint employ of the Philadelphia Electric Company, Pennsylvania Power & Light Company and Public Service Electric & Gas Company. He will direct the operation of the so-called outer ring involving the interconnection of the three companies. His headquarters will be at Hazleton, the location of the Pennsylvania Power & Light Company's system operators. Mr. Keenan was graduated from Purdue University in mechanical engineering in 1913.

Edward Porter Vice-President of Philadelphia Electric

Edward Porter, who has been controller of the Philadelphia Electric Company since September 12, 1928, was elected a vice-president of the company at a meeting of the directors on April 10. Mr. Porter, who succeeded Walter E. Long as controller when the latter was elected a vice-president of the United Gas Improvement Company, has a service record of 34 years with the U. G. I. Company. He was born and educated in Philadelphia, later taking special courses in accounting at the Peirce Business College and Drexel Institute.

He entered the employ of the U. G. I. in 1894 as a clerk. His advancement was rapid and he was successively promoted to bookkeeper and later accountant. In 1918 he was appointed assistant general auditor, becoming general auditor in 1919, a position he held when he was made controller of the Philadelphia Electric Company.

He is a member of the National Electric Light Association, the American Gas Association, of which he has served as chairman of the Accounting Section; the Pennsylvania Gas Association and the Pennsylvania Electric Association.

W. E. Bann Assumes Executive Duties in Shreveport

W. E. Bann was elected vice-president of the Southwestern Gas & Electric Company at a recent meeting of the board of directors to succeed A. Lieberman, who was named president. Mr. Bann entered the company's employ in the fall of 1904 as messenger and collector. He was later made meter reader and, after rising consistently in the ranks, in 1912 he became purchasing agent and was given a combined position of auditor and purchasing agent in 1918. He was appointed manager of the Texarkana division June 1, 1926, the position he held at the time of his recent promotion.

Mr. Bann takes an active part in the various utility associations, having been elected president of the Arkansas Utilities Association in May, 1928. He is a member of the executive committee representing Arkansas in the Southwestern Geographic Division of the National Electric Light Association. He also has a wide variety of community activities, being a charter member and past-president of the Kiwanis Club of Texarkana, director of the Texarkana Chamber of Commerce and director of the Arkansas State Chamber of Commerce.

OTTO SNYDER, executive vice-president of the New York Power & Light Corporation, has been named a vice-president of the Mohawk Hudson Power Corporation and M. E. SKINNER, vice-president and commercial manager of the New York Power & Light Corporation, has in addition to these duties been elected a vice-president of the Mohawk Hudson organization. J. D. WHITTEMORE, executive engineer of the New York Power & Light Corporation, has been elected a vice-president of the Mohawk Hudson Power Corporation. Mr. Whittemore will continue to perform his executive duties with the New York Power & Light Corporation.

F. H. HILL, vice-president and general manager of the Elmira (N. Y.) Water, Light & Railroad Company, has been nominated for director in the United States Chamber of Commerce. In his varied business activities Mr. Hill has demonstrated leadership and an intense interest in the industrial and economic problems of the day. He has for many years been prominent in Chamber of Commerce affairs, being a past-president of the Elmira Association of Commerce and having served several years as a director of that asso-

ciation besides serving on many important committees. For the past year he has been a councilor in the Chamber of Commerce of the United States.

A. Lieberman Heads Southwestern Utility

A. Lieberman was elected president of the Southwestern Gas & Electric Company at a meeting of the board of directors held recently at Shreveport, La. Mr. Lieberman has been associated with the Southwestern Gas & Electric Company since January, 1926. He first joined the company as assistant to the president, directing the general management of the properties in that capacity. In 1928 he was elected vice-president and general manager of the company.

Prior to his connection with the Southwestern Gas & Eectric Company Mr. Lieberman was connected with the Morrison and McCall interests of St. Louis, Mo., for ten years, having charge of all their properties in Arkansas, Oklahoma and Missouri. During his association with Morrison and McCall he acquired many utility properties, some of which are at this time owned and operated by the Southwestern Gas & Electric Company. Mr. Lieberman was also recently elected a vice-president of the Central & Southwest Utilities Company at a meeting of the board of directors. He was born in Lafayette County, Mo., in 1886 and during the past 25 years has been engaged in the utility business.

Dr. Sperry Receives New Honor

Dr. Elmer A. Sperry, engineer and inventor, has been elected "a member with distinction" in Tau Beta Pi, an engineering society. This honor has only been conferred once before. The initiation, followed by a dinner, took place at the Hotel Astor, New York, April 18. Dr. Sperry is the holder of more than four hundred patents on mechanical and electrical devices and in recent years has directed his attention chiefly to the gyroscope and its application to the stabilization of ships and airplanes. At the present time he is chairman of the board of directors of the Sperry Gyroscope Company, Brooklyn, N. Y., and president of the American Society of Mechanical Engineers. In the course of his active and useful career he has received many awards and decorations both here and abroad.

Obituary

Sandford H. Brownlee, who had been connected with the engineering department of the Niagara Falls Power Company for several years, died at his home in Niagara Falls, N. Y., April 6 following a short illness. Mr. Brownlee was formerly a member of the Utah State Legislature and at one time was a correspondent for the Associated Press at Denver, Colo., and San Francisco.

George S. Carson, president of the Iowa City Gas & Electric Company for many years prior to its absorption into the United Light & Power Company, and also president of the Iowa Gas & Electric Company, Washington, Iowa, before it was taken over by the Iowa Southern Utilities Company, died April 6. Mr. Carson was born in Iowa City in 1862 and spent his life there. At the time of his death he had retired from active participation in the electric utility business.

James A. Horne, who had been connected with the publicity department of the General Electric Company, Schenectady, for ten years, died March 31 at his home in that city of pleuro-pneumonia. Mr. Horne was well known in Schenectady, having been identified with political and civic activities as well as industrial enterprises. He entered the employ of the General Electric Company in 1911 as a clerk in the production department and in 1918 was transferred to the regulator engineering department, where he remained until 1919, when he became identified with the publicity department.

Wingrove Bathon, formerly Washington correspondent of the Electrical World and other McGraw-Hill publications, died April 18.

William S. Barker, comptroller of the Public Service Corporation of New Jersey, died at Clifton Springs, N. Y., from heart disease April 2 after an illness of almost a year. Mr. Barker was 54 years old and was born in Philadelphia. He was graduated from Swarthmore College in 1895 and entered the employ of the United Gas Improvement Company of Philadelphia. He remained with this organization for several years and then became connected with the Public Service Corporation.

William G. Ross, Canadian financier, died in Montreal April 15 in his sixty-fifth year. Mr. Ross was born in Montreal and received his education in the public schools of that city. Starting his career as a chartered accountant, he subsequently became identified with the public utility industry, and it was not long before he was a prominent figure in light, power and transportation enterprises in Canada. In 1903 he became vice-president of the Montreal Light, Heat & Power Company and later managing director of the Montreal Street Railway. In 1910 he was elected a vice-president of the American Street Railway Association, the first Canadian to hold the position. In 1911, when conditions in the asbestos industry in Quebec were chaotic, Mr. Ross took the reins and as a result of his executive and administrative ability the industry soon recovered from its slump. At the time of his death he was president of the Asbestos Corporation, Ltd.

W. S. Sultan, until about three years ago manager of the Globe Light & Power Company, Globe, Ariz., died in Bisbee April 10. Mr. Sultan recently had been living in Los Angeles.

Sir Lomer Gouin, K.C.M.G., Lieutenant-Governor of the Province of Quebec and a director of the Montreal Light, Heat & Power Consolidated, died March 28. Sir Lomer was also a director of the Shawinigan Water & Power Company, Canada Power & Paper Company, Royal Exchange Assurance Company, Bank of Montreal and of numerous other industrial enterprises.

S. L. Allen, who served for more than 25 years as manager of the Georgetown Water, Gas & Electric Company, Georgetown, Ky., died April 8 in Louisville as the result of an operation. Mr. Allen was active in civic affairs as well as in public utility circles, having been a director of the Georgetown Chamber of Commerce.

Charles W. Woodale, well known mining engineer and prominently identified with the Anaconda Copper Mining Company for many years, died in Boston April 11 in his seventy-fourth year. After receiving his technical education at the Massachusetts Institute of Technology he removed to Colorado. From 1898 to 1918 he served as manager of the branch of the Anaconda Copper Mining Company at Butte, Mont., and also was chairman of the company's bureau of safety from 1914 to 1920. Mr. Woodale was an active member of several technical societies and the author of numerous papers which he read before engineering associations.

Charles P. Coleman, engineer, of New York, died at the Mayflower Hotel, Washington, D. C., April 13 of double pneumonia after an illness of a few days. Mr. Coleman was well known in industrial circles in the East, having been at various times chairman of the board of directors and president of the Worthington Pump & Machinery Corporation, secretary and treasurer of the Singer Sewing Machine Company, president of the International Motor Company, assistant general superintendent of the Lehigh Valley Railroad and purchasing agent and assistant to the president of the Bethlehem Steel Company. At the time of his death he was president of the Mount Hope Bridge Company and Sandusky Bay Bridge Company.

Financial and Statistical News

LIGHT trading characterized the market on the opening day of this week and stocks receded slowly and somewhat irregularly during the extremely dull day that followed. The price movement was narrow and large losses did not occur, the outstanding feature being rather a speculative indifference. Wall Street attributed this lack of interest to the uncertainty incident to the convening of the national legislature, but the President's message had no effect on the market one way or the other. On Wednesday a recovery set in.

——CONDITIONS OF THE GENERAL MARKET affected certain utilities and moderate losses were recorded for American Gas, Cities Service, American Superpower issues, Associated Gas and United Gas Improvement. Several of these stocks recovered later in the week. Mohawk Hudson gained approximately 8 points.

——CALL MONEY, which ended last week at 7 per cent, went to 8 per cent on Monday and advanced on Tuesday to 9 per cent late in the trading day when the banks had withdrawn a substantial sum from the market for government funds to cover the distribution of interest on U. S. Treasury bonds. On Wednesday it returned to 7½ per cent.

Rise in Output Continues Unabated

Weekly reports of energy output by subsidiaries of the American Gas & Electric Company, constituting about 5 per cent of the country's total, continue to show large gains compared with the corresponding periods of 1928. For five weeks ended March 16, 23 and 30 and April 6 and 13 the respective kilowatt-hours and per cent gains were 73,177,962 and 17, 72,397,304 and 18, 71,780,826 and 17, 71,386,766 and 17, 72,672,787 and 18.

North American Output Up 14 per Cent During Quarter

Electric output of the North American Company's subsidiaries during the first quarter of 1929 was 1,648,600,000 kw.-hr., which is an increase of 14.04 per cent over that of the same quarter of 1928.

New England Power Offer to Worcester Stockholders

An alternative offer has been made by the New England Power Association to stockholders and holders of stock trust certificates of the Worcester Electric Light Company in lieu of the cash price of $226 per share of $25 par by which the control of the property was lately acquired by the association. The cash offer remains in effect, but until April 29 inclusive any stockholder may exchange all but not less than all of his holdings for the preferred shares of the association on a basis of 2¾ preferred shares for each share of common stock of the Worcester company. The preferred shares are of $100 par value and pay cumulative dividends at the rate of 6 per cent per annum, also being Massachusetts tax refund up to 6 per cent. The Worcester company is now paying dividends of $6 per share, so that stockholders who elect to make the change will receive more than double their present dividend return. The association will assume management of the Worcester company May 1.

Canadian Industries Use Much Purchased Energy

During the past five years the output of electric energy from central electric stations in Canada has almost doubled and during the past six years it has increased by 136 per cent, according to a recent bulletin issued by the Dominion Bureau of Statistics. In 1928 the large stations, which report monthly and which produce over 99 per cent of the total of all stations, generated 15,899,000,000 kw.-hr. This was an increase of 11 per cent over the 1927 output and of 96 per cent over the 1923 output.

During 1928 the exports of electric energy to the United States amounted to 1,587,710,000 kw.-hr. or approximately one-tenth of the total production. This export included 454,156,000 kw.-hr. of off-peak power developed by the Niagara stations.

Manufacturing industries are operating much of their machinery electrically, as is shown in the table by groups for 1926, the latest year available. In a number of individual industries the per cent of electrical horsepower is very high, for example:

Automobile, 100; cement, 100; paper goods, 100; printing and bookbinding, 100; electrical apparatus and supplies, 97; brass and copper goods, 96. In mining, half the horsepower is operated on purchased electrical energy.

Recent Listings

The New York Stock Exchange has authorized the listing on or after April 1 of not exceeding 4.477 shares of common stock of Federal Light & Traction Company, par $15, on official notice of issuance as a stock dividend, making the total amount applied for 452,175 shares of common stock. There have also been authorized an additional 272,600 shares of common stock (without par value) of the Public Service Corporation of New Jersey on official notice of issuance and payment in full, making the total amount applied for 6,138,888 shares of common stock. There have been also listed on the big board 28,000 additional shares of class A stock without par value of the Utilities Power & Light Corporation, on official notice of issuance and payment in full, making the total amount applied for 1,098,000 shares of class A stock. On the Boston Stock Exchange there have been placed temporary certificates for 1,282,971 shares without par value of common stock of the Associated Gas & Electric Company.

New Utility Offerings

Massachusetts Utilities Associates has made an offering of 5 per cent sinking fund gold debentures, series A, to the amount of $4,000,000 at 94 and interest to yield about 5½ per cent. These securi-

Horsepower in Canadian Industries, 1926

Industry Group	Total Power Employed, Hp.	Electric Motors Operated — By Power Generated in the Industries, Hp.	Electric Motors Operated — By Purchased Power, Hp.	Electric Motors Operated — Total Hp.	Per Cent Electric — Total	Per Cent Electric — Purchased
Vegetable products	267,643	21,490	160,171	181,661	68	60
Animal products	96,151	3,667	62,250	65,917	69	65
Textiles and textile products	153,295	23,766	93,367	117,133	76	61
Wood and paper products	1,552,885	228,500	710,554	939,054	60	46
Iron and steel products	422,356	70,946	250,548	321,494	76	59
Non-ferrous metal products	228,870	29,097	139,799	168,896	74	61
Non-metallic mineral products	305,265	9,841	276,169	286,010	94	90
Chemicals and chemical products	63,635	3,506	40,912	44,418	70	64
Miscellaneous industries	44,148	1,509	36,564	38,073	86	83
Total manufacturing industries	3,134,248	392,322	1,770,334	2,162,656	69	57
Mining industries	336,880	64,277	167,241	231,518	69	50

ties, dated April 1, 1929, mature April 1, 1949. Proceeds will be used by the association for the retirement of a portion of its convertible participating 5 per cent preferred shares and for the repayment of bank loans.

Cumulative preferred stock, numbering 35,000 shares and bearing interest at the rate of $6 per annum, was offered by the Peoples Light & Power Corporation, the price being 96 and accrued dividend, to yield 6.25 per cent. The holder of each share of this preferred stock will be entitled, subsequent to April 1, 1930, and subject to previous redemption, to purchase one share of class A common stock at $60 per share, to and including January 1, 1933, and at $70 per share thereafter, to and including January 1, 1938.

Canada's Power Growth Parallels Our Own

Power production from central electric stations in Canada during the month of January broke all previous records. The output totaled 1,507,114,000 kw.hr., compared with a previous high of 1,459,633,000 in October, 1928. The high output for January is further emphasized by comparison with the same month in 1928, 1927 and 1926, when the output totaled 1,325,768,000, 1,131,212,000 and 951,450,000 kw.-hr., respectively.

There was a decline in exports of electricity during January, the total being 114,267,000 kw.-hr., as compared with 122,734,000 in the preceding month and 124,019,000 in January, 1928.

AMERICAN SUPERPOWER STOCKHOLDERS APPROVE INCREASE IN CAPITALIZATION.—Stockholders of the American Superpower Corporation at a meeting held April 15 approved an increase in the authorized first preferred stock from 400,000 to 750,000 shares. An amendment to the certificate of incorporation was also voted in regard to the voting rights of the first preferred stock, making provision for this stock to vote in the event of four defaults in quarterly dividends. All directors were re-elected.

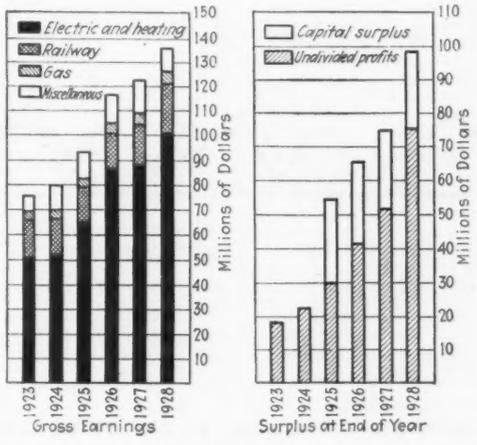
CENTRAL STATES ELECTRIC STOCK DIVIDEND APPROVED BY STOCKHOLDERS.—The stock dividend of 100 per cent voted by the directors of the Central States Electric Corporation, as announced in the March 23 issue of the ELECTRICAL WORLD, was approved by the stockholders at a meeting held March 29. An increase in the authorized common stock from 2,500,000 shares of no-par value to 10,000,000 shares of no-par value was voted. Of the additional stock 1,185,000 shares will be distributed to shareholders in this stock dividend. The dividend is payable April 25 to holders of record April 15.

EVERY MINNESOTA COUNTY SERVED.—Electric service is supplied in every county in Minnesota, notwithstanding the circumstance that the state is largely rural and that some areas are quite sparsely populated. This is brought out in a map showing the distribution of domestic electric meters, recently published by the North Central Electric Association, 803 Plymouth Building, Minneapolis, Minn. Almost 50 per cent of them are in the two counties containing the Twin Cities, Minneapolis and St. Paul. More than 10 per cent are in St. Louis County, which contains Duluth. In addition to the meters in cities and towns, it is estimated that there are 10,000 farm meters in the state.

North American Company's Net Income Rises 13.26 per Cent

AN INCREASE of 10.96 per cent in gross earnings and a gain of 13.26 per cent in net income from operation shows the progress made by the North American Company during 1928. These figures also reflect the decrease from 53.46 per cent for 1927 to 52.49 per cent for 1928 in the proportion of gross earnings required for operating expenses, maintenance and taxes.

While the various sources of revenue contributed to this increase, the electrical department showed the largest single growth. Electric output of 6,103,032,653 kw.-hr., an increase of 14.36 per cent over the output for 1927, established a new record. For the several systems the aggregate of the maximum demands was 1,351,129 kw., an increase of 12.47 per cent, and the average annual load factor was 51.42 per cent, compared with 50.71 per cent in 1927. At the end of last year the total installed electric generating capacity of power plants owned was 1,818,902 kw. At that date customers receiving electric service numbered 1,169,046.



Financial growth of North American Company since 1923

Analysis of the various aspects of the company's earnings statement and balance sheet indicates an exceedingly strong position. The balance, after all preferred dividends, amounting to $22,582,721, is an increase of 29.53 per cent over that of the previous year and is equivalent to $4.68 per share on the average number of shares outstanding during the year, as against $4.06 for the year before. Under the company's policy of paying stock dividends, this entire balance is available for investment in the business. On December 31 last reserves amounted to $105,353,505. Undivided profits were $74,874,413 and capital surplus $23,859,317, making a total surplus of $98,733,730.

An interesting feature of the North American Company's operations is the fact that "service and investment are becoming more and more closely associated in the minds of the public served." The stockholders of the various subsidiaries now number more than 101,000 and consist chiefly of customers and residents of the territories in which they operate. The stockholders of the North American Company alone number 43,299 and the distribution of this stock is interesting. Every state in the Union is represented, as well as 700 foreign stockholders and more than 400 banks, trust companies, insurance companies, investment trusts and other institutions. A detailed study of the company's stock distribution was published in the ELECTRICAL WORLD a short time ago.

The common stock of the North American Company, on which is paid a 10 per cent stock dividend, is now selling at around 100, which is approximately 22 times last year's earnings. This ratio, studied in comparison with some of the other leaders in the power and light field, does not show the same degree of inflated value which is the case with some of the others. The company's stock sold at ten times its earnings as far back as 1924. In 1926 and 1927 the market evaluated the stock at around fourteen times earnings on the average price. During 1928 the average price was seventeen times earnings, so that the increase has been due to a steady market evaluation rather than a sudden increase based entirely on market conditions.

The net increase in property and plant account was $111,499,910. The net working assets, or the excess of current assets over current and accrued liabilities, amounted to $20,801,928.

LOS ANGELES GAS & ELECTRIC CORPORATION PLANS TO ISSUE GOLD BONDS.—The Los Angeles Gas & Electric Corporation has applied to the California Railroad Commission for authority to issue $483,300 par value of its series "J" general and refunding mortgage gold bonds to the Security Trust & Savings Bank, trustee, for the purpose of deposit in its sinking fund.

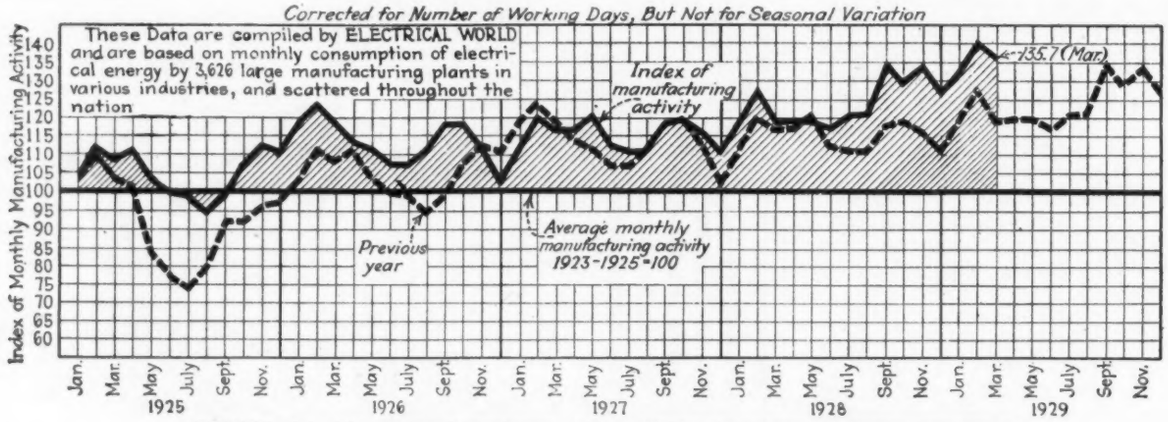
Industrial Activity in March
14.8 per Cent Above Last Year

SEASONAL influences were manifest in the March manufacturing operations as indicated by the consumption of electrical energy for power purposes by the manufacturing plants of the country. The March rate of activity for general industry in the country as a whole was 3.3 per cent under February, the record month of industrial operations, but was 14.8 per cent above March last year. The drop in the rate of activity as compared with February was slightly more than normal, but a drop of such proportions was to be expected on account of the very high activity prevailing in general industry during February. The average rate of production in general industry during the first quarter of the current year was 12.2 per cent above that reported during the same period last year, slightly higher than the preliminary estimates.

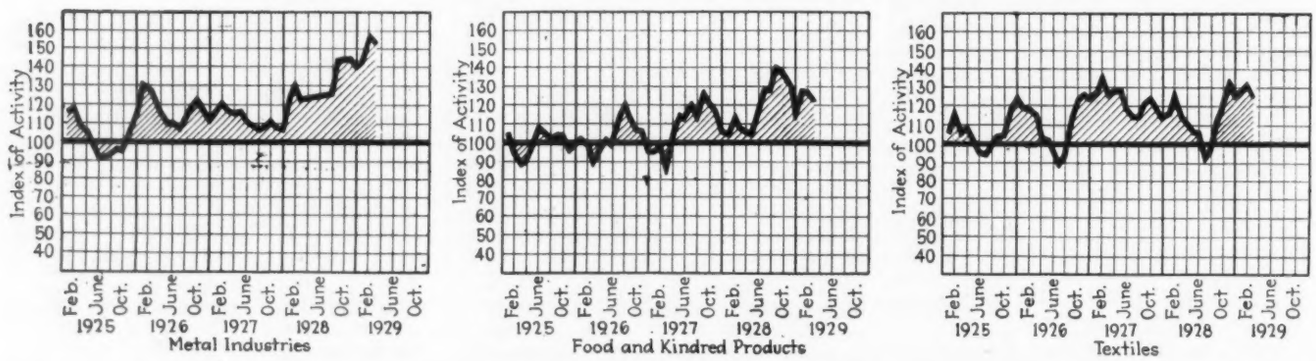
While the succeeding months of the second quarter will undoubtedly witness seasonal reductions in manufacturing activity, possibly of slightly more than normal proportions, yet there is every reason to believe that an unusually high rate of activity will be evident at least during the following three months.

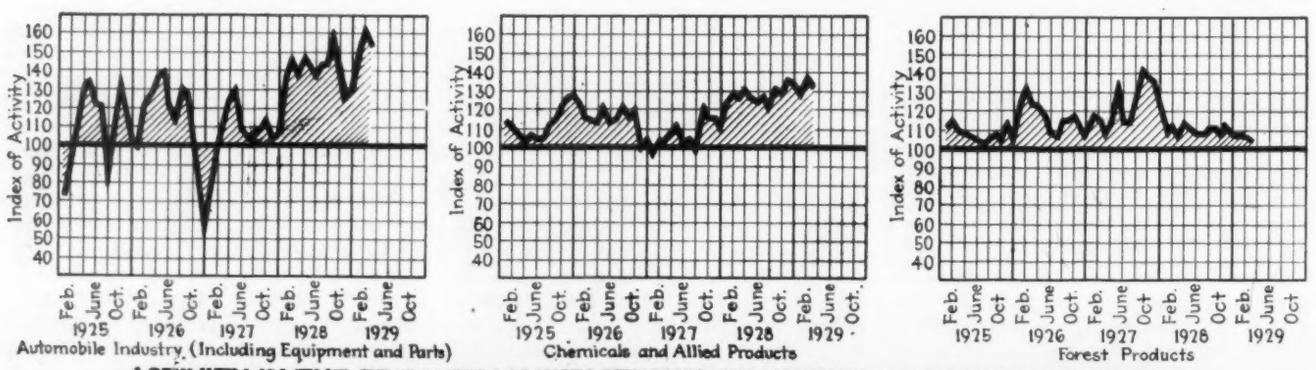
Every section of the country reported a seasonal drop in the rate of activity during March as compared with February, after corrections are made for the number of working days in the two months, but the rate of March operations in every section was materially over March last year. The greatest gain over March, 1928, was recorded in the Western States with a gain of 22.6 per cent, followed by the North Central States with a gain of 16.0 per cent, the Middle Atlantic States with 14.3 per cent, New England 11.9 per cent and the Southern States with 8.7 per cent.

Activity in the rubber products industry rose to new heights during March, but every other manufacturing group recorded a seasonal drop in the rate of operations as compared with February. The lumber products and leather products groups, however, were the only industries recording a rate of activity during March under that of March last year. Ferrous and non-ferrous metal-working plants registered the largest gain over March last year of any manufacturing group, recording a gain of 29.0 per cent. Rolling mills and steel plants showed a rate of operations that was 28.8 per cent greater than March, 1928. The automobile industry, which includes the production of replacement parts and accessories, registered the first decline since November as compared with the previous month, but the March operations were still 13.4 per cent above March last year. The textiles industry recorded a gain of 10.2 per cent over March last year. The leather products industry continued to operate on a plane materially under last year.


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Index of manufacturing activity
135.7 (Mar.)
Previous year
Average monthly manufacturing activity 1923-1925=100
Index of Monthly Manufacturing Activity
Jan. Mar. May July Sept. Nov.
1925 1926 1927 1928 1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES





ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Market Conditions

Electrical Equipment Exports Reach New High Level

Exports of electrical equipment from the United States during February amounted to $10,625,444 in value, which is a new level for that month, according to preliminary figures issued by the Department of Commerce. This figure is an increase of $2,733,658 over the total for the same month last year.

Larger increases were registered in lighter electrical equipment, although smaller gains were also shown for generators and transforming or converting apparatus. The foreign market for radio apparatus continues to expand. Shipments of this class of material in February amounted to more than a million dollars.

Next in importance to Canada, which is the largest market for such material, was Italy, with imports of radio receiving sets from the United States amounting to $102,005. Shipments of insulated copper wire and cable showed a substantial increase during February, as did also exports of bare copper wire.

Active Electrical Year in British Columbia

Indicating the tendency of Vancouver home builders to insist upon the best possible standard of electrical wiring, the eighth annual report of the Electrical Service League of British Columbia shows that the year 1928 more than doubled 1926 and 1927, added together, in the number of "red seal" homes built. The policy laid down by the directors in 1927 calling for general lighting educational work, industrial and commercial lighting campaign, "red seal" campaign, campaign for better lighting in the offices of Vancouver was continued and met with marked success, the report states. In connection with general education and league work, approximately 40,000 pieces of literature were sent out to home builders, architects, electrical contractors and local propery owners' organizations. Officials of the league, acting as consultants, revised the electrical layout of 94 residences, 74 stores, seventeen offices and sixteen factories, as well as giving advice in the electrical installation for schools, cafes, hospitals, dance halls and other buildings. An intensive campaign for better lighting in offices resulted in a large number of inquiries and in the rewiring or improvement to the wiring of several of the largest office buildings in the city. Owners of old apartment houses have also been induced to bring the electrical wiring up to modern standards.

Copper and Lead Decline in Quiet Metal Market

Trading has been in considerably less than normal volume for copper, lead and zinc in the week ended Wednesday, and prices have declined further. Copper is a cent and a quarter lower than a week ago, but lead, zinc, and tin have given way but little. At present levels, more stability is in evidence, the improved London quotations in the last day or two were encouraging and there is a feeling that metal buying is likely soon to improve, which would arrest any further decline in metal prices. Buying of semi-manufactured metals and metal products has been adversely affected by the drop in prices, but manufacturers are so well sold ahead that this will not worry them for a time and their plants are as busy as ever.

NEW YORK METAL MARKET PRICES

	Apr. 10, 1929 Cents per Pound	Apr. 17, 1929 Cents per Pound
Copper, electrolytic	19.25	18
Lead, Am. S. & R. price	7.15	7.00
Antimony	9.50	9.50
Nickel, ingot	35	35
Zinc, spot	6.625	6.95
Tin, Straits	46.375	45.50
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price April. 17 1929, 19¼ cents.

Some copper was sold at 18¾ cents delivered Connecticut last Thursday, but most of the business for that and the two succeeding days was booked at 19¼ cents. The tonnage was not large, however, and on Monday, in the effort to interest consumers in placing orders, the custom smelters offered copper down to 18 cents, a level which has since been maintained. The larger producers, however, are out of the market, being sold out through June, and with much of their July production also booked.

Buying of copper has been better at the 18-cent level, but the market cannot be called active. Dates of shipment requested have been pretty evenly distributed over April and the next four months.

Engineering Work Ahead of Last Year

The high rate of contract letting in the engineering construction field, even when compared with last year's record, is now well known, according to the *Engineering News-Record*. The total for the quarter is $1,122,000,000, a gain of 42 per cent.

It is natural to expect that construction in April, May and June will be more active than in the first three months of the year. In 1928 it was 25 per cent more active, as measured by the value of heavy contracts. If the increase is the same in 1929, contracts in the next three months will total $1,400,000,000. Thus, if contract letting in the second quarter of this year steps up in the same ratio as it did in the second quarter of 1928, the total for the half year will be $2,522,000,000, or 44 per cent more than in the first half of 1928.

Engineering construction contracts of the first half of this year may, therefore, be expected to reach a total of $2,497,000,000, compared with $1,774,000,000 in the first half of 1928. This is an increase of 40 per cent. The total for the year 1928 was $3,550,671,000.

Value of Construction Contracts by Sections in the United States and Total for Canada, March, 1929

Thousands of dollars (-000 omitted)

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Jan. 1 to Date	Canada
Water-works	$45	$632	$43	$1,792	$480	$476	$3,468	$10,933	.....
Sewers	181	1,885	874	1,459	1,500	131	6,030	17,671	$411
Bridges	25	1,981	327	1,107	1,293	251	3,844	14,255	.....
Excavations, etc.	15	240	250	.....	438	846	1,789	13,653	.....
Streets and roads	687	3,547	2,472	3,416	2,831	3,790	16,743	60,052	295
Industrial buildings	3,910	5,843	10,165	5,351	1,592	2,607	29,468	155,256	2,535
Commercial buildings	9,479	142,800	9,258	25,352	17,151	13,421	217,461	600,181	4,150
Federal government	79	856	1,406	803	995	282	4,421	16,935	.....
Unclassified	250	23,532	16,845	1,555	17,525	730	60,437	213,508	6,250
March, 1929*	14,671	181,316	41,640	40,835	43,805	38,059	360,326	.....	13,641
February, 1929*	12,793	126,306	18,386	104,814	51,768	50,716	364,783	.....	14,107
March, 1928†	22,190	145,607	26,465	90,028	54,053	41,178	379,521	.....	22,394
Year to date, 1929	54,537	463,980	80,979	197,960	196,150	128,336	.....	1,121,942	38,995
Year to date, 1928	48,550	303,231	64,504	175,589	120,440	78,481	.....	790,795	39,713

*Four weeks. †Five weeks.

Market Conditions

CONTINUING to follow out the anticipated trend in the East, orders have been placed for large quantities of insulators and other equipment for transmission lines and substations. Textile mills show a tendency to be more active and are placing orders for machinery.

——IN THE SOUTHEAST orders for transformers, poles and other pole-line equipment show that business is satisfactory there.

——GENERALLY CONDITIONS IN THE MIDDLE WEST are good. Car loadings increased over last week and utility companies are busy with line extension work.

——THE PACIFIC COAST AREA seems in a more healthy state than a month ago, orders for electric locomotive and substation equipment being among the principal ones placed.

Industrial Sales Increase in Eastern District

Industrial account shows a noticeable improvement in the Eastern district. Commitments are growing heavier and inquiries are developing to a higher point. Despite the increased levels for motors, the market has a particularly strong tone in this line and sizable transactions are taking place. A manufacturer of copper products has placed an order for motor units for plant service totaling $100,000 in the Philadelphia district. A producer of compressors in Connecticut has contracted for a quantity of synchronous motors for equipment use to cost $60,000. Pennsylvania steel mills and Midwest automobile manufacturers are in the market for motor requirements and a satisfactory volume of business is expected. Proposed installations for office buildings in the metropolitan district are another feature of current demand, but business with cement and textile mills is of reduced order, with inquiries light.

Central-station buying continues to trend to transformers, circuit breakers, switchgear and kindred equipment. A New York maker has secured a contract from a Massachusetts power company for a bank of 21 large transformers to cost $1,000,000. A railroad in New York has placed an order for transformers, converters, switchgear and other substation apparatus totaling $300,000. A metropolitan power interest has purchased a quantity of switchgear and miscellaneous equipment to an amount of $50,000 and there is a sizable amount of additional business of this character in sight. Electric railway account gives particular promise for an early volume of orders. A maker says inquiries are running higher in this line than for several years past, due to the electrification programs of several trunk line railroads, and record sales are anticipated. A manufacturer of switchgear in the metropolitan district reports improved sales.

The wire and cable business maintains a fair level and inquiries show tendencies for decrease. A northern New York power company has placed an order for a quantity of paper-wound cable to cost $125,000. Prime movers are recording only an average business. A Pennsylvania manufacturer has secured a contract for a large turbo-generator unit for a Texas installation, the order for boilers going to a New York company. Industrial heating equipment, including electric furnaces, shows average sales, with inquiries stated as nominal by a maker. Marine business appears to be improving and recent orders cover five new turbo-electric passenger and cargo steamers for New York companies, three of which will represent an investment of $21,000,000, and other contracts are pending. Construction projects are as follows:

The New York Central Railroad Company, New York, will receive bids until April 26 for railway motors and multiple-unit control equipment (Contract No. 8-1929). The New York Edison Company, New York City, plans a plant unit on Avenue D, to cost $75,000. The Nevada Consolidated Copper Company, New York, will make expansions at its mills at Ray and Chino, Nev., to cost $600,000. Auburn, N. Y., will receive bids until April 30 for one vertical shaft hydraulic turbine and one electric generator, 156 kva., and switchboard, etc. The Raritan Copper Works, Perth Amboy, N. J., will make improvements to cost $150,000. William Rademaker & Son, Newark, N. J., will build a bookbindery at North Arlington, N. J., to cost $90,000. The Atlantic City Electric Company, Atlantic City, N. J., will build a power substation at Williamstown, N. J., to cost $75,000. Lansdale, Pa., contemplates a municipal electric light and power plant to cost $125,000. Walker Brothers, Philadelphia, plan an electrical equipment manufacturing plant at Spring Mills, Pa., to cost $90,000. The Pennsylvania Power & Light Company, Allentown, Pa., will make improvements in street lighting system at Camp Hill, Pa. The Quartermaster Supply Officer, Washington, will receive bids until April 24 for one automatic electric plant and one electric-driven water pump (Circular 114). The General Purchasing Officer, Panama Canal, Washington, will receive bids until May 3 for insulators, flashlights, electric fixtures and other supplies (Panama Schedule 1956). The Purchasing Agent, Post Office Department, Washington, is asking bids until April 24 for 500 ½-hp. motors. The Kreider-Reisner Aircraft Company, Hagerstown, Md., will build an addition to cost $80,000. The General Baking Company, New York, will receive bids until April 26 for a baking plant at Washington, D. C., to cost $200,000.

Insulator Business Active in New England

The insulator market in the New England district is extremely active and orders aggregating $500,000 were placed by several companies. Other orders reported were placed by substations, one for insulators amounting to $16,000 and numerous other smaller ones. Industrial equipment is active. Small motor sales amounted to $100,000. Textile mills are more active in buying and machinery manufacturers are interested. Power equipment for power plants is moving well and recently one 500-kw. and two 1,000-kw. turbo-generator units were placed. Waterwheels and generators for two small hydro-electric plants were recently ordered, while transformer orders are active and the negotiations are increasing. Small switch and control apparatus sales are keeping up to a good level and the trend of general scheduled supplies is steady. Opinions gathered from leading manufacturers indicate that steady, encouraging sales trends are ahead for the coming months. Construction projects are as follows:

The Boston & Maine Railroad, Boston, Mass., plans an engine house and shops at Somerville, Mass., to cost $1,500,000. The Petroleum Heat & Power Company, Stamford, Conn., will make extensions to its oil burner manufacturing plant to cost $1,000,000.

Southeast Reports Satisfactory Business

A satisfactory volume of electrical business is reported in the Southeast, but few orders of individual moment are to be noted in the central-station field. The largest single order was from a power company in the Carolinas for small power transformers amounting to $20,000, though the wire and cable orders of a Georgia company aggregated $24,500. One company ordered $10,700 in creosoted pine poles, crossarms and pole-line hardware, while a meter equipment order amounting to $8,350 also was placed. Some other central-station orders were for $3,700 in small sign equipment and $3,500 in small disconnect switches. A Georgia company ordered power transformers costing $10,700 for a customer's industrial installation.

Tire manufacturing plants being constructed in the Southeast were responsible for some sizable orders, a plant in Alabama ordering $75,000 in motors and textile mill equipment and $10,000 in lighting units, while a Georgia plant ordered $130,000 in motors and textile mill equipment. A rayon plant being built in North Carolina ordered power panelboards costing $17,000, $5,000 worth of industrial switches and $5,000 in mill construction supplies. A Georgia cotton mill let engineering contracts covering electrification of its plant and

ordered motor equipment approximating $22,000 and will later order $15,000 in wiring materials. The Georgia Power Company, Atlanta, Ga., has purchased the privately owned electric distribution system in Warm Springs, Ga. Construction projects are as follows:

The C. F. Sauer Company, Richmond, Va., will build an addition to its flavoring extract plant, to cost $100,000. The Homer Laughlin China Company, Newell, W. Va., plans an addition to cost $1,000,000. The Southern Textile Machinery Company, Nashville, Tenn., plans an addition to cost $65,000. The Export Leaf Tobacco Company, Winston-Salem, N. C., plans an addition to cost $90,000. The Southern Public Utilities Company, Charlotte, N. C., plans a transmission line to Yadkinville, Smithfield, N. C., and vicinity. The Alabama Power Company, Birmingham, Ala., plans a street-lighting system at Millport, Ala.; and transmission line extensions at Opelika, Ala., and vicinity. Atlanta, Ga., will install an ornamental lighting system in the business district. The Atlanta Harness & Reed Manufacturing Company, Atlanta Ga., will build an addition to cost $65,000. The Port Everglades Refining Company, Fort Lauderdale, Fla., contemplates an oil refining plant to cost $2,000,000. The Bureau of Yards and Docks, Navy Department, Washington, will receive bids until May 1 for refrigerating equipment for Pensacola, Fla. (Specification 5845.)

Line Construction Material Sales Active in St. Louis

There has been only a slight falling off in the demand for stock sizes of apparatus in the St. Louis district. The movement of line construction materials and house-wiring supplies has been very active. A 4,000-kw. turbo unit was sold for a municipal plant in central Missouri at $79,000. A 2,000-kw. unit with a condenser for a Kansas company to cost $45,000, a lot of truck type switching equipment for an oil refining company costing $20,000, seven engine-driven generators for a natural gas distributing company to drive auxiliaries in line pumping stations costing $15,000, a lot of outdoor switches for a local power company costing $5,000 and electrical equipment for a rock-crushing plant in northern Arkansas to cost $3,000 are orders reported for the week. Construction projects are as follows:

The Barnes Dairy Products Company, Cape Girardeau, Mo., plans a milk condensing plant to cost $65,000. The Pevely Dairy Company, St. Louis, will build an addition to its bottling plant to cost $50,000. The Yates Laundry Machinery Company, North Kansas City, Mo., will expand its plant to cost $60,000. The Phillips Petroleum Company, Bartlesville, Okla., plans a refining plant near Pueblo, Colo., to cost $300,000. Muskogee, Okla., plans to install a flood-lighting system and beacon lamps at its municipal airport. The O.K. Ice Cream Company, Pine Bluff, Ark., plans an addition to cost $125,000. The Coca-Cola Bottling Company, Morrillton, Ark., plans a plant to cost $90,000. The Central Power & Light Company, San Antonio, Tex., plans a transmission line from Sinton to Robstown, Tex., and vicinity. The Gulf States Utilities Company, Beaumont, Tex., plans a power substation to cost $40,000.

Machinery Orders Heavy on Pacific Coast

The past week was marked by heavy machinery sales on the Pacific Coast. Westinghouse reports five industrial electric locomotives for a Longview, Wash., timber yard and plant and eight substation circuit breakers valued at $15,000 for Stockton, Calif. Other machinery orders covered one complete Westinghouse switchboard equipment valued at $75,000 for the new Honolulu substation and a $15,000 assortment of motors and transformers for a Hawaiian plantation, comprising six motors of sizes 300 to 50 hp. and six transformers of 500 and 150 kva. Other interesting orders covered a 25-car trainload of radio receiving sets for Central Valley distribution, a 41-mile, 60,000-volt transmission line to tap the east portal of the Feather River canyon, $9,500 worth of sizes 500,000-circ.mil and No. 10 leaded 4,500-volt sector cable for a power company and an $8,000 award for a 3-mile, 11-kv. power irrigation line in the West Stanislaus area. Street-lighting business is particularly brisk, including an $82,000 Long Beach award and an estimated $54,000 Oakland extension comprising 159 duplex ornamental standards and the necessary equipment. Other cities contemplating extensions or installations are Monterey, Ukiah, San Leandro, Petaluma, Richmond, Porterville and Salinas, Calif. San Mateo, Calif., is in the market for 59 single standards and Alameda, Calif., for 88 combination ornamental lighting and power poles. The outstanding building projects include the $1,500,000 Metro-Goldwyn-Mayer studio for talking pictures at Culver City, Calif.; a $1,000,000 addition to the Los Angeles coliseum, a $500,000 wing for the present state building in San Francisco and a $3,500,000 Portland, Ore., hotel.

The following apparatus, costing approximately $180,000, was purchased by the Puget Sound Power & Light Company, Seattle, for the Shuffleton steam auxiliary and the Renton substation: 67 3,000-kv. disconnecting switches, three 55,000-volt potential transformers, two 73,000-volt current transformers, a storage battery and storage battery connections, a storage battery motor-generator set, 5,000 hp. in motors, copper tubing for buses, 50 5,000-volt bus supports, a main switchboard, a 2,300-volt truck type switchboard and 40 and 60-volt truck type switchboards. The small motor sales reported were brisk, the majority going to lumber mills, woodworking plants and dealers. Twenty machines from 50 hp. down were reported sold to a Tacoma lumber mill and 30 to dealers in the Grays Harbor district and $3,000 worth of gang-operated disconnecting switches was sold to two central-station companies. The board of contracts and awards, Tacoma, Wash., awarded the contract for the Lake Cushman hydro-electric dam to L. H. Hoffman of Seattle and Portland for $440,547 and for the tunnel to the Youdall Construction Company of San Francisco for $1,773,933. An engineer was commissioned by the city of Centralia, Wash., to prepare plans for an 11,000-hp. municipal hydro-electric plant costing $1,000,000 and a bid call is expected soon. Cold storage plants are planned at Yakima costing $90,000, at Wapato costing $40,000 and at Olympia costing $15,000. A coal-briquetting plant is planned at Bellingham costing $25,000. Construction projects are as follows:

The Municipal Power Bureau, Los Angeles, plans a transmission line at Wilmington, Calif. Pasadena, Calif., plans a power substation at Lamanda Park, Calif., to cost $65,000. Los Angeles, Pomona and Beverly Hills, Calif., plan ornamental lighting systems. The Hines Lumber Company, Burns, Ore., will build a mill to cost $1,000,000. The Western Oil & Refining Company, Los Angeles, plans an oil storage and distributing plant at Portland, Ore., to cost $500,000. The Cottage Lake Lumber Company, Renton, Wash., plans an electric-operated lumber mill to cost $75,000. The Pend-Oreille Lead & Zinc Company, Spokane, Wash., plans a zinc mill at Metalline, Wash., to cost $3,000,000. Tacoma, Wash., plans a cold storage plant to cost $300,000, to be occupied and operated by the Pacific Terminal Company. The Pacific Power & Light Company, Portland, Ore., will build an addition to its power substation at Walla Walla, Wash., to cost $50,000. Matson & Company, Selah, Wash., plan a cold storage plant to cost $100,000. T. J. Lloyd, Twin Falls, Idaho, heads a project to build a local cold storage and refrigerating plant to cost $350,000. Terry, Mont., and Bennett, Colo., plan ornamental lighting systems.

Most Sections of Middle West Report Increased Business

Quarterly reports of the steel and automotive industry indicate an excellent condition in the Middle West and recent statistics show a much-needed increase in building activity. Car loadings increased somewhat with a marked increase in merchandise and miscellaneous products. Railroad buying of equipment is quite substantial, with a reported purchase by the Northern Pacific Railroad of 500 auto freight cars to cost $1,500,000 and the Erie Railroad of ten steel baggage and express cars from the Pullman Car & Manufacturing Company of Chicago. Industrial activity is holding up well with a continued increase noted in mail order sales. The utility companies are busy, with a large amount of line extension work scheduled for this month. Apparatus purchasing has been somewhat light, while a large amount of small orders are being placed for circuit breakers, relays, meters and switches. Jobbers' sales are generally satisfactory. Construction projects are as follows:

Argyle, Wis., plans improvements in its power plant to cost $20,000. The Edison Wood Products, Inc., New London, Wis., plans an addition to cost $70,000. The Sterling Ice Company, Dowagiac, Mich., plans an addition to cost $50,000. The Duluth, South Shore & Atlantic Railroad, Marquette, Mich., contemplates an ore dock and distributing plant to cost $1,500,000. The Detroit Wax Paper Company, Detroit, will build a plant at River Rouge, Mich., to cost $500,000. The Evans Flex-

ible Reamer Corporation, Chicago, plans an addition to cost $85,000. The Joslyn Manufacturing & Supply Company, Chicago, will build a bolt and nut manufacturing plant at Franklin Park, Ill., to cost $90,000. The Barber-Colman Company, Rockford, Ill., will build an addition to its forge shop to cost $75,000. The New Indiana Chair Company, Jasper, Ind., plans an addition to cost $150,000. The American Steel Foundry Company, Chicago, plans expansions in its plant at Alliance, Ohio, to cost $500,000. The Transue & Williams Steel Forging Company, Alliance, Ohio, plans extensions in its plant to cost $600,000. The Minnesota & Ontario Paper Company, Minneapolis, Minn., will build an addition to its mill at International Falls, Minn., to cost $150,000. The Toledo Scale Company, Toledo, Ohio, plans an addition to cost $1,000,000. The Wehle Baking Company, Youngstown, Ohio, plans a baking plant to cost $100,000. The Northern States Power Company, Minneapolis, Minn., contemplates a power plant at Fargo, N. D., to cost $800,000. The Northern Pacific Railway Company, St. Paul, Minn., plans extensions in its engine house and shop at Duluth, Minn., to cost $50,000. Warren, Minn., plans extensions in its municipal power plant, to cost $75,000. The Western States Utilities Company, Central City, Neb., plans a power plant at Elgin, Neb., to cost $40,000. Harvard, Neb., contemplates a municipal light and power plant to cost $35,000. J. F. Decker & Sons, Mason City, Iowa, plan an addition to its meat packing plant to cost $300,000. Benson, Minn., and Waterloo, Iowa, plan ornamental lighting systems.

Activities of the Trade

Modern Equipment Succeeds O. E. Szekely Corporation

The assets of the O. E. Szekely Corporation, Holland, Mich., have been taken over by the newly formed Modern Equipment Company, which will continue the manufacture of portable pumps and generating sets at Muskegon, Mich. The generating sets, which may be had in the portable form on steel skids, or on cast bed plates for permanent installation, use Continental "Red Seal" motors and Westinghouse dynamos. The direct-current line is from 3½ to 50 kw. and the alternating from 5 to 62½ kva. A switchboard, on which is mounted ammeter, voltmeter, rheostats and fused knife switch, is a permanent part of each set, which is completely wired and requires only take-off connections. The pump sets made by the company include piston, diaphragm and centrifugal types. Dealer inquiries on the two lines are invited.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, manufacturer of electrical instruments and circuit breakers, announces the appointment of Carl P. Lohr, 401 National Bank of Commerce Building, St. Louis, as its district sales agent for the St. Louis territory. J. C. McDougall, Alaska Building, Seattle, Wash., has been appointed as its district sales agent for the states of Washington, Oregon and Alaska.

HARVEY HUBBELL, INC., Bridgeport, Conn., manufacturer of electrical specialties, announces that its New York City office has been moved from 30 East 42d Street to the Chanin Building, 122 East 42d Street. The company says that its greatly increased business has necessitated moving into larger quarters.

THE NATIONAL BATTERY MANUFACTURERS' ASSOCIATION, 7 East 44th Street, New York City, will hold its next convention at the Hotel Gibson, Cincinnati, Ohio, on April 24, 25 and 26.

THE ANACONDA WIRE & CABLE COMPANY, a subsidiary of the Anaconda Copper Mining Company, has authorized the purchase of all the assets of the Tubular Woven Fabric Company of Pawtucket, R. I., and the Maring Wire Company of Muskegon, Mich., and Anderson, Ind. The Tubular company is one of the best-known manufacturers of rubber-covered wire and the Maring company is one of the largest manufacturers of magnet wire.

Ingersoll-Rand Company Earnings Show Increase

The net income of the Ingersoll-Rand Company, 11 Broadway, New York City, was nearly $1,500,000 more in 1928 than in the previous year and the total of $8,017,186 was the largest in the history of the company. Of this amount, 75 per cent was paid out in common dividends and the surplus rose to $14,083,588, the highest since the 100 per cent stock dividend in 1922.

Ingersoll-Rand's management has continued through another year its usual policy toward common-stock holders and last year three extra $1 dividends were declared besides the $3 rate. Over the past eight years an average of 70 per cent of net income has been distributed to common holders. The following table shows the company's record in this regard:

Year	Net Income	Per Cen of Net Pd. on Common, Average	Total Surplus
1928	$8,017,186	75	$14,083,588
1927	6,550,896	77	11,623,127
1926	7,878,097	64	10,153,645
1925	6,147,445	31	7,426,662
1924	4,454,623	43	6,591,798
1923	5,971,138	102	4,212,149
1922	3,578,262	90	6,525,727
1921	582,240	187	17,308,429
Total	$43,179,887	70	

Wadsworth Electric Holds Get-Together

Practically all the contractors of greater Cincinnati, northern Kentucky and surrounding territory recently attended one of the Wadsworth Electric Manufacturing Company's (Covington, Ky.) get-together meetings. The meeting was presided over by L. G. Kuhlman, treasurer and general manager of the company. Those present visited the factory and inspected the new developments in safety electrical switches and the general process necessary to build safety electrical switches. Several leaders of the district spoke on various subjects regarding the electrical contracting business.

General Electric Refrigerator Distributors Convene

About 175 General Electric refrigerator distributors, members of distributing organizations and G.E. officials recently attended a two-day conference at the Little Theatre of the Public Auditorium at Cleveland. Every state in the Union was represented by the men who were responsible in less than two years for putting the General Electric refrigerator in the enviable position it occupies today. "This conference," P. B. Zimmerman, sales manager of the General Electric refrigeration department, said, "was for the distributors themselves." Plans were presented for the biggest selling season the General Electric Company has experienced. Various models were on exhibit and selling methods were conveyed in the form of interesting playlets put on by the skillful actors.

THE LEONARD REFRIGERATOR COMPANY, Grand Rapids, Mich., reports that the production of refrigerators by the company during the past six months has exceeded by 32 per cent the production for the same period of one year ago and March production was 36 per cent greater than that of any previous month in the company's history, according to a statement made by A. H. Jaeger, sales manager of the company.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has received an order from the Duquesne Light Company, Pittsburgh, for a 60,000-kw. turbo-generator unit and its necessary condensing equipment. The apparatus will be built at the South Philadelphia Works of the Westinghouse company and will be installed in the Reed power plant at Brunot's Island, Pittsburgh. The company also has received orders from the Virginia Electric & Power Company, Richmond, Va., for four type B-1 weatherproof outdoor switch houses, each for the control of a 13,200-volt, three-phase, grounded-neutral, 60-cycle circuit, and from the Oklahoma Gas & Electric Company, Oklahoma City, Okla., for five type B-1 weatherproof outdoor switch houses.

New Equipment Available

Totally Inclosed Beacon for Airport Use

A new type of revolving airport beacon with all the moving parts inclosed within a glass dome, and with a beam that, in clear weather, can be seen by aviators when 66 miles away, has been developed by the General Electric Company. The 20-in. deep parabolic mirror, the automatic lamp changer equipped with two 1,000-watt, 115-volt airway beacon lamps, the louvres for cutting out stray light and the rotating mechanism are all inclosed within a 24-in. hemispherical heat-resisting glass dome. All of the parts can be inspected through the glass and the glass dome is hinged so that easy access to all of the mechanism can be had. Should one of the lamps fail or burn out while in service, the automatic changer immediately swings the other lamp into focus.

A deep parabolic mirror is used with the filament of the lamp at the focus of the mirror and at the same time even with the edge of it. The beam spread is 7½ deg. and the beam candlepower 1,075,000. Zenith indication is obtained at all points, with the distinctiveness of the beacon increased by an eclipse during each revolution. The beacon, weatherproof finished, can be rotated at 6 r.p.m., or such other speeds as required.

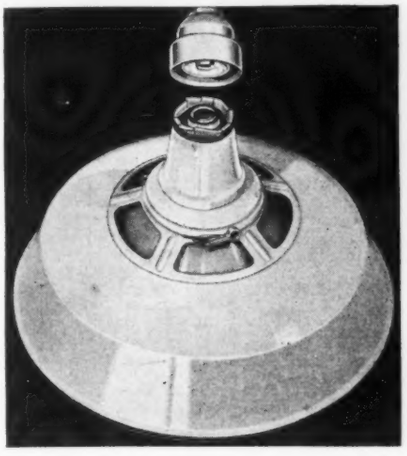
COCHRANE BLOW-DOWN METER.—As a means of measuring boiler blow-off in order to maintain high boiler efficiency the Cochrane Corporation of Philadelphia has improved its meter with an additional pen and special multiplying mechanism to record the leakage flow on a magnified scale. A reliable boiler blow-down meter gives a continuous record of both frequency and amount of blow-off valve discharge, including leakage and regular blow-downs. This information is indispensable in calculating heat balances and efficiencies. In the new blow-down meter an arm connected to the regular pen bears upon a lever, which in turn bears upon an arm attached to the leakage pen, the multiplying lever being held in engagement with the pen arm lever by a counter-balance.

AN IMPROVED COMPLETE LINE OF BEAM CLAMPS for either indoor or outdoor substations, permitting the changing of existing installations to accommodate new apparatus without the need of drilling the structural steel members, has been developed by the General Electric Company. These beam clamps are commonly used to fasten ladder steps to outdoor stations, for mounting outdoor insulators and switching equipment, as well as forming a quick and effective method of attaching one steel member to another. They consist of hot-dip galvanized malleable-iron castings and necessary bolts and nuts. When installed they will not slip because of the pressure developed by the mounting bolts.

Detachable Reflector Unit Allows Easy Cleaning

A new type 79 "Glassteel" diffuser has been developed by the Benjamin Electric Manufacturing Company, Des Plaines, Ill., which is said to facilitate frequent and thorough cleaning at a minimum labor cost. The characteristic illuminating qualities and appearance of the Benjamin diffusers have been retained and the new feature of quick detachability for easy cleaning added.

The type 79 consists of but two parts,



one a permanent wiring base, either for pendent stem or outlet box, and the other a complete unit comprising reflector, lamp and glass inclosing globe. This unit is attached to the terminal base by means of a bayonet joint and securely locks in place with a 60-deg. clockwise turn. A counter-clockwise turn releases the unit in one simple movement and a clean unit is then fastened in place over moving machinery or other working area and the dirty unit cleaned without loss of productive time. The built-in lamp-holding element is designed to assure the proper position of the lamp with respect to the reflector. A four-point spring suspension ring carries the inclosing globe and prevents it from working loose even under extreme vibration.

Fuse Pullers of Laminated Horn Fiber

A full line of fuse pullers made up of laminated horn fiber giving plenty of jaw surface and mechanical strength for removing fuses from the tightest of clips with a straight, steady pull, and with complete safety, even though the fuses might, by chance, be alive, is announced by the Ideal Commutator Dresser Company, Sycamore, Ill.

In the removal of blown fuses the utmost caution is desirable. Not only is there the possibility that the switch may not be out or that the fuse may not be blown, but improper removal is very likely to impair the clips. Very often the greatest cause for premature fuse blowing is loose clips. Prying out fuses with a screwdriver or stick, or jerking them out with cautious, unsteady fingers, is very likely to bend the clips, thereby causing heating when the current is applied, thus annealing the clips and rendering them useless.

The Ideal fuse pullers announced by the Ideal Commutator Dresser Company comprise the following: Midget size with three laminations 5 in. long, pocket size with five laminations 7½ in. long, giant size with seven laminations 12 in. long and jumbo size with nine laminations 20 in. long.

"Deion" Principle Applied to Line Starters

Increased safety, economy and rating on class 11-200 line starters due to the use of "Deion" contactors is claimed by the Westinghouse Electric & Manufacturing Company in the line-starter field. This "Deion" contactor is said to be the most effective arc-rupturing device yet incorporated in starters of similar ratings. It confines, divides and smothers the arc quickly without the usual flash and attendant scattering of flame. Not only does it provide for a greater degree of safety to the operator, but it also permits a smaller inclosure and a consequent decrease in the overall size of the starter. The arc is ruptured so fast and with so little fire that contact and arc chute life are materially lengthened.

These contacts are guaranteed to rupture twelve to sixteen times their normal current-carrying capacity at rated voltage under the most severe operating conditions of low power factor and sustained voltage.

The "Deion" contactors are an application of the fundamentally new invention of Dr. Slepian, Westinghouse engineer.

Direct-Current Cam Switch

A new direct-current cam switch, designated CR-3108, developed to satisfy the needs of central stations for a device to control auxiliaries such as pumps, blowers, etc., is announced by the General Electric Company. The switch can also be used for similar non-reversing applications where the current inrush or starting torque is not severe or the operations are not frequent.

The new switch is available in two forms. Both are for non-reversing service with armature regulation over five points, while one form has field regulation over 22 points. The intermittent armature current capacity is 1,000 amp., while the same capacity continuous rating is 500 amp. The switches are rated 550 volts maximum.

Electrical Patents

Announced by U. S. Patent Office

(Issued April 2, 1929)

Re. 17,252. ELECTRICAL RELAY; C. S. Snavely, Pittsburgh, and W. B. Wells, Wilkinsburg, Pa. App. filed Jan. 29, 1929.

1,707,217. PROCESS FOR OBTAINING THIN NICKEL FLAKES; E. Breuning, Hagen, Germany. App. filed June 28, 1927.

1,707,234. RECTIFYING UNIT AND METHOD OF PRODUCING THE SAME; C. E. Ogden, Cincinnati, Ohio. App. filed June 27, 1927.

1,707,236. APPARATUS FOR EFFECTING A REPEATED CLOSING OF AUTOMATIC SWITCHES; F. Schmidlin, Baden, Switzerland. App. filed Aug. 7, 1922.

1,707,252. BASE SOCKET; L. W. Chubb, Edgewood Park, Pa. App. filed Apr. 29, 1922.

1,707,269. ELECTRICAL DISTRIBUTION SYSTEM; W. Koch, Berlin, Germany. App. filed July 27, 1926.

1,707,278. ELECTRICAL MEASURING INSTRUMENT; C. Oman, Swissvale, Pa. App. filed Oct. 28, 1926.

1,707,286. FREQUENCY METER; F. S. Stickney, Pittsburgh, Pa. App. filed June 7, 1926.

1,707,291. REMOTE METERING DEVICE; G. G. Waite, Wilkinsburg, Pa. App. filed Apr. 29, 1927.

1,707,292. SPARK-PLUG TERMINAL; W. M. Wilcox, Elberton, Ga. App. filed Nov. 1, 1927.

1,707,293. MOTOR-CONTROL SYSTEM; M. J. Wohlgemuth, Pittsburgh, Pa. App. filed Jan. 19, 1927.

1,707,296. MULTIPLE-UNIT GENERATOR SYSTEM; A. F. Brotz, Kohler, Wis. App. filed Oct. 14, 1921.

1,707,308. ELECTRIC HEATER UNIT; A. D. Keene, Pittsburgh, Pa. App. filed June 24, 1924.

1,707,315. GROUND STICK; R. C. Palmer, Saxton, Pa. App. filed June 25, 1928.

1,707,317. APPARATUS FOR AND METHOD OF CONNECTING CABLES; P. P. Pipes, Mansfield, Ohio. App. filed Sept. 24, 1926.

1,707,318. ELECTRICAL OVEN; R. Reinhold, Leipzig, Germany. App. filed Jan. 21, 1928.

1,707,322. ELECTRIC WATER HEATER; C. J. Scanlan, Bloomington, Ill. App. filed Feb. 8, 1926.

1,707,324. METHOD OF PRODUCING JOINTS IN OIL-FILLED CABLES WITH HOLLOW CONDUCTORS; K. Schlecker, Berlin-Grunewald, Germany. App. filed Feb. 7, 1928.

1,707,327. ELECTRIC-FUSE CONNECTION AND TERMINAL CONTACT; M. Soferman, Philadelphia, Pa. App. filed March 30, 1926.

1,707,403. BRUSH HOLDER FOR REVOLVING BRUSHES; J. K. Kostko, Ferguson, Mo. App. filed May 13, 1927.

1,707,405. ELECTRIC WELDING; E. Lunn, Chicago, Ill. App. filed Feb. 7, 1927.

1,707,406. FURNACE ELECTRODE; P. L. J. Miguet, St.-Julien-De-Maurienne, France. App. filed Feb. 9, 1927.

1,707,423. ELECTRIC MOTOR; B. F. Bailey, Ann Arbor, Mich. App. filed July 13, 1925.

1,707,424. INDUCTION MOTOR; B. F. Bailey, Ann Arbor, Mich. App. filed Feb. 18, 1927.

1,707,433. AUTOMATIC ELECTRIC WELDING APPARATUS; A. J. Hand, Berkeley, Calif. App. filed Feb. 15, 1927.

1,707,445. ELECTRIC SAFETY RAZOR; S. W. Moon, Chicago, Ill. App. filed Sept. 1, 1926.

1,707,450. PROCESS OF SEPARATING CERIUM; F. Sommer, Berlin-Charlottenburg, Germany. App. filed Apr. 21, 1925.

1,707,459. CONTROLLING DEVICE FOR ELECTRIC MOTORS; W. N. Clurman, Long Beach, N. Y. App. filed March 29, 1927.

1,707,460. CONTROL SYSTEM; R. C. Deale, Plainfield, N. J. App. filed Dec. 29, 1924.

1,707,461. SWITCH; F. Farrell, Chicago, Ill. App. filed Oct. 31, 1924.

1,707,479. SWITCH; E. H. Jacobs, Chicago, Ill. App. filed Nov. 3, 1924.

1,707,589. CONTACT SCREW; R. H. Williams, Evansville, Ind. App. filed Apr. 1, 1927.

1,707,590. ELECTRICAL INSULATION; W. W. Winship, Freeport, N. Y. App. filed July 28, 1924.

1,707,594. DEVICE FOR INDICATING OSCILLOGRAPH CURVES AS STATIONARY; F. Bedell, Ithaca, N. Y. App. filed May 7, 1927.

1,707,596. COMMUTATOR; H. J. Bertram, Kansas City, Mo. App. filed March 24, 1928.

1,707,652. CONTROL INSTRUMENT; R. P. Brown, Philadelphia, Pa. App. filed Oct. 29, 1924.

1,707,700. REINFORCED ELECTRIC CABLE; H. Wodtke, Buffalo, N. Y. App. filed Sept. 20, 1921.

1,707,773. ELECTRICAL-QUANTITIES MEASURING SYSTEM; W. Sarfert, Dresden, Germany. App. filed May 10, 1924.

1,707,784. SWITCH DEVICE FOR ALARM CIRCUITS; M. J. Cawley, New York, N. Y. App. filed June 15, 1927.

1,707,808. INSULATED WIRE FOR ELECTRIC INSTALLATION; P. Jordan, Berlin-Steglitz, Germany. App. filed July 2, 1927.

1,707,829. LIGHTING FIXTURE; F. Wagner, Los Angeles, Calif. App. filed Oct. 24, 1927.

1,707,857. ASYMMETRIC CELL; W. E. Holland, Philadelphia, Pa. App. filed Nov. 18, 1925.

1,707,873. CIRCUIT CLOSER; E. Poulin, Central Falls, R. I. App. filed Dec. 16, 1926.

1,707,909. AUTOMATIC SIGNALING APPARATUS; J. Gullong, South Hadley Falls, Mass. App. filed Aug. 27, 1925.

1,707,936. RECTIFIER; G. B. Coleman, San Francisco, Calif. App. filed Nov. 22, 1922.

1,707,937. APPARATUS FOR CHARGING TILTING SMELTING FURNACES; J. E. Gerlach, Duisburg, Germany. App. filed Feb. 29, 1928.

1,707,950. ADJUSTMENTS FOR INDUCTANCES OF VARIOMETERS; W. L. MacHugh, Philadelphia, Pa. App. filed July 28, 1924.

1,707,959. CONDENSER; J. A. Fried, Flushing, N. Y. App. filed Oct. 12, 1923.

(Issued April 9, 1929)

1,707,982. ELECTRIC HEATER; H. R. Humphrey, Kalamazoo, Mich. App. filed March 26, 1927.

1,707,984. CAR DUMPER; R. W. Kaltenbach, Cleveland, Ohio. App. filed Feb. 9, 1926.

1,708,000. ELECTRIC GEARING MOTOR WITH CENTRIFUGAL CLUTCH; W. R. Uggla, Morby, Stocksund and A. G. F. Wallgren, Stockholm, Sweden. App. filed June 27, 1927.

1,708,003. WELDING TORCH; R. A. Weinman, Schenectady, N. Y. App. filed Feb. 20, 1926.

1,708,014. ELECTROMAGNET; J. Geisslinger, Geneva, Switzerland. App. filed Aug. 29, 1927.

1,708,038. LOW-LOSS INSULATOR; L. T. Wilson, East Orange, N. J. App. filed Dec. 24, 1925.

1,708,061. ELECTRIC JET WAVE COMMUTATOR AND INTERRUPTER; J. F. G. P. Hartmann, Copenhagen, Denmark. App. filed March 17, 1926.

1,708,072. ARC WELDING SYSTEM; P. P. Alexander, Marblehead, Mass. App. filed April 1, 1927.

1,708,073. METHOD AND MECHANISM FOR DETERMINING THE MOISTURE CONTENT OF PAPER OR OTHER MATERIAL; A. Allen, Bangor, Me. App. filed May 1, 1925.

1,708,077. SWITCH; L. P. Boll, Maplewood, and A. C. Hansen, Jr., St. Louis, Mo. App. filed Oct. 17, 1927.

1,708,079. ELECTRIC PRESSING APPLIANCE; C. A. Brewer, Noroton Heights, Conn. App. filed July 10, 1925.

1,708,093. ELECTRIC MOTOR; B. B. Holmes, Stonington, Conn. App. filed July 26, 1926.

1,708,095. IGNITION APPARATUS; H. C. Hubbell, West Springfield, Mass. App. filed Nov. 26, 1927.

1,708,102. BATTERY-CHARGING SYSTEM; G. Marenti, Detroit, Mich. App. filed Sept. 3, 1926.

1,708,138. DOORKNOB BURGLAR ALARM; M. Hildahl, Seattle, Wash. App. filed April 19, 1927.

1,708,155. AUTOMATIC HEAT-REGULATING MEANS; M. S. Runsvold, San Diego, Calif. App. filed Aug. 30, 1926.

1,708,192. MANUFACTURE OF BODIES FROM METAL POWDER; C. F. Sherwood, Detroit, Mich. App. filed May 7, 1927.

1,708,222. ELECTRIC RELAY; B. E. Getchell, Plainville, Conn. App. filed May 2, 1927.

1,708,225. CIRCUIT BREAKER; F. C. Kroeger, Anderson, Ind. App. filed April 7, 1923.

1,708,235. OVERFLOW ALARM FOR FILTERS; W. W. Nugent, Chicago, Ill. App. filed July 2, 1920.

1,708,237. ELECTRIC HEATER; F. J. Pioch, San Francisco, Calif. App. filed May 28, 1928.

1,708,292. PROTECTING DEVICE FOR ELECTRICAL CABLE CONNECTIONS; O. Buys, Pittsburgh, Pa. App. filed March 14, 1923.

1,708,294. ELECTRICAL MEASURING INSTRUMENT; C. E. Foster, Letchworth, England. App. filed April 27, 1925.

1,708,333. STRAIN GAUGE; E. B. Smith, Ames, Iowa. App. filed Dec. 14, 1926.

1,708,334. SLOW-SPEED SYNCHRONOUS MOTOR; M. C. Spencer, East Orange, N. J. App. filed Oct. 25, 1926.

1,708,347. LIGHTING MOTOMETER; P. D. Yankoff, Fort Smith, Ark. App. filed May 5, 1923.

New Trade Literature

ELECTRIC FURNACES. — The Ajax Electrothermic Corporation, Ajax Park, Trenton, N. J., is distributing bulletin No. 4a which describes the Ajax-Northrup 3-kva. converter and furnaces. The principle of operation is illustrated and described.

ELECTRIC RANGES.—Catalog No. 16-B issued by the Standard Electric Stove Company, Toledo, Ohio, describes and illustrates its entire line of electric domestic ranges, heavy duty ranges, ovens, griddles, hotplates, cookers, water heaters, coffee urns, urn heaters, serving tables, etc. A price list also is included.

ELECTRICAL WIRING DEVICES.—Harvey Hubbell, Inc., Bridgeport, Conn., is distributing catalog No. 19 covering the Hubbell electrical wiring devices, together with illustrations, dimensions, prices, etc.

GENERATOR.—The Rochester Electric Products Corporation, Rochester, N. Y., has issued bulletin No. 94, which describes its diverter pole generator for floating with bus control batteries. Illustrations showing some typical installations of the diverter pole generator sets are included.

ELECTRICAL EQUIPMENT. — Special publication No. 1829 issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., covers the selection and application of electrical equipment for heating and ventilating systems, including the selection of motors, load characteristics, a table of air velocities for various types of buildings, types of control and power consumption. A few illustrations showing some installations of Westinghouse heating and ventilating motors also are included.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase is desired in Liverpool, England (No. 37,755), of coffee percolators, tea kettles, immersion shaving outfits, illuminated shaving mirrors, traveling irons, etc.

An agency is desired in Valparaiso, Chile (No. 37,692), for illuminated advertising signs.

Purchase and agency are desired in Johannesburg, South Africa (No. 37,793), for burglar alarms for offices and residences.

An agency is desired in Santiago, Chile (No. 37,761), for dry batteries and flash lights.

An agency is desired in Chemnitz, Germany (No. 37,725), for storage batteries.

An agency is desired in Berlin, Germany (No. 37,763), for electric dish washers and hotel electric appliances.

Purchase is desired in Lucerne, Switzerland (No. 37,753), of electric agricultural household and small industrial appliances and bright copper wire and porcelain insulators of all sorts.

An agency is desired in Winnipeg, Canada (No. 37,748), for household electric appliances, another (No. 37,750), for household electric appliances, wiring supplies and lighting fixtures.

Purchase and agency are desired in Calgary, Canada (No. 37,751), for household electric appliances.

Purchase or agency is desired in Sheffield, England (No. 37,756), for household electric appliances.

Purchase is desired in Rosario, Argentina (No. 37,752), of small electric motors.

Purchase is desired in Geneva, Switzerland (No. 37,690), of electrical laboratory ovens.

An agency is desired in Karlsruhe, Germany (No. 37,759), for electric paint sprayers.

Purchase or agency is desired in Rosario, Argentina (No. 37,752), for electric household refrigerators.

An agency is desired in Quebec, Canada (No. 37,760), for electric household refrigerators.

Purchase and agency are desired in Stockholm, Sweden (No. 37,754), for electric refrigerators and vacuum cleaners.

An agency is desired in Toronto, Canada (No. 37,758), for portable electric saws including circular blades.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Electricity at the Breakfast Table

AT FIRST GLANCE a decrease from over $75,000,000 in the value of electric household, heating and cooking devices manufactured in 1925 to $73,000,000 in 1927 would seem to indicate a recession in the rate of home electrification. The picture brightens on closer examination. About half the reported value was in one item, vacuum cleaners. This suffered a real drop of about $4,850,000, due not to any important decrease in the number of units made but to a reduction in their average price.

The omission of this one product changes the decrease of more than $2,000,000 into an increase approaching $3,000,000, or 7.6 per cent. Curious fluctuations in the individual items as to total value and average cost are evident in the table, taken from a preliminary report of the Census of Manufactures for 1927.

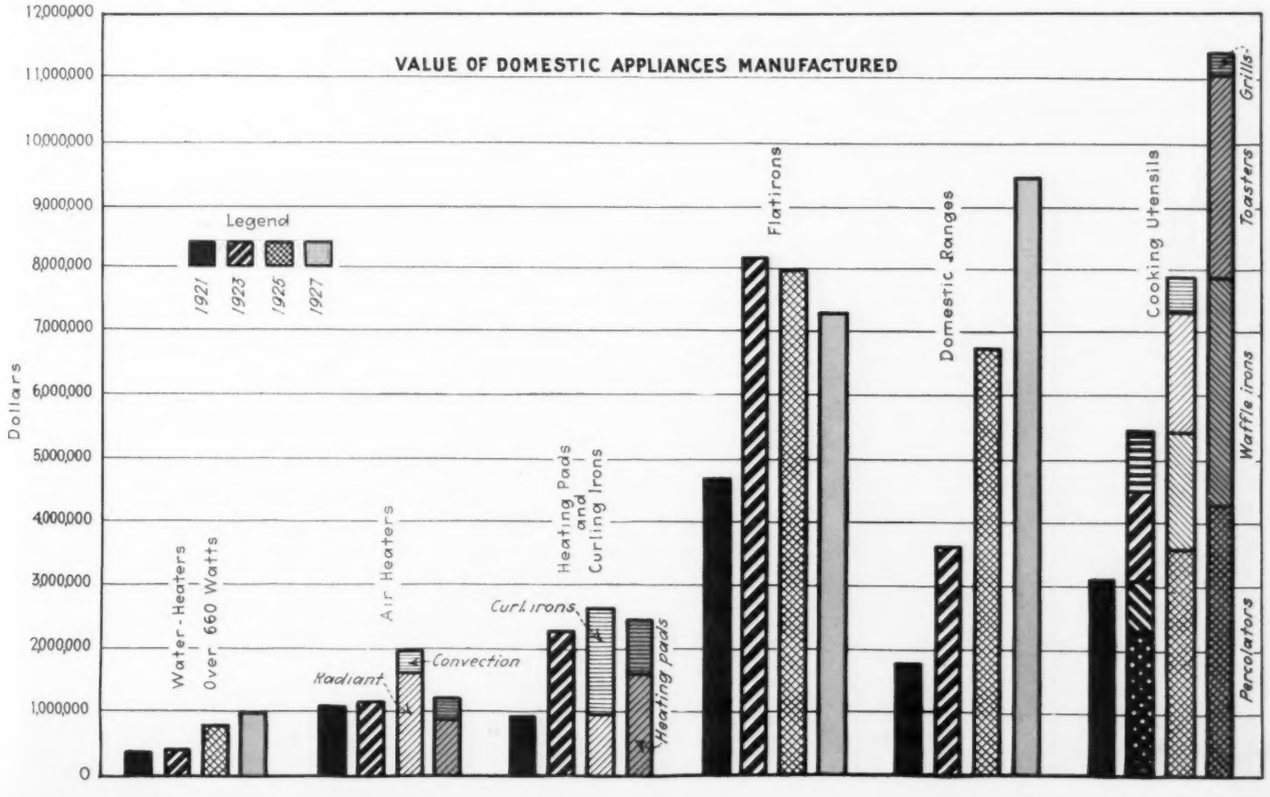
Cooking utensils gained greatly in popularity during the biennium, with the exception of electric grills. Coffee, toast and waffles are electrical products on several million American breakfast tables. Fifty per cent more heating pads were produced in 1927 than in 1925. Of flatirons the output is nearly 3,000,000 a year, while the large energy consumers, ranges and water heaters, are being made by the hundred thousand. The figures are known only for the odd-numbered years, as no census is taken for the even ones.

For vacuum cleaners the high mark in output was reached in 1923. Prior to the years in the table, production in 1919 was 977,339 units; in 1921, 739,534; in 1923, 1,240,742. Corresponding values were $21,842,439, $19,752,905 and $35,981,514. The maximum value came in 1925.

Washing and ironing machines are not included in this census classification. They were valued at slightly more than $70,000,000 in 1925.

	1927		1925	
	Value	Number	Value	Number
Air heaters:				
Convector	$343,859	96,619	$374,367	99,297
Radiant	904,603	209,493	1,653,327	396,318
Cooking utensils:				
Grills	301,541	196,304	577,628	209,318
Percolators	4,297,395	791,726	3,593,496	434,095
Toasters	3,236,484	1,209,484	1,885,780	735,856
Waffle irons	3,601,411	653,893	1,864,257	315,777
Curling irons	984,496	1,355,615	1,703,088	1,534,786
Disk stoves, hot plates, etc	772,028	253,042	1,123,823	216,859
Domestic ranges, 2½ kw. and over	9,527,120	112,963	6,776,963	85,158
Electric fireless cookers	727,093	73,406	486,195	63,201
Flatirons	7,347,563	2,937,258	7,998,429	2,936,361
Heating pads	1,518,188	396,272	976,708	265,588
Vacuum cleaners	35,120,748	1,091,632	39,971,111	1,107,592
Water heaters over 600 w	1,018,570	63,664	769,009	54,042
Miscellaneous household, heating and cooking devices	3,232,175	.....	5,347,984	.....
Total	$72,933,274	.....	$75,102,165	.....

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers to quote or use them for any legitimate purpose. While no acknowledgment is required, users will, by crediting the ELECTRICAL WORLD, help it in obtaining and compiling further basic information.



Southern Manufacturing Above Last Year

REPORTS received by the ELECTRICAL WORLD upon the consumption of electrical energy by about 550 large manufacturing plants operating in the Southern States indicates that the March rate of operations was considerably higher than that of last year. Southern manufacturing operations were under those reported for the same month of the year previous from March, 1928, until last February, and the gain recorded in February was further increased in March.

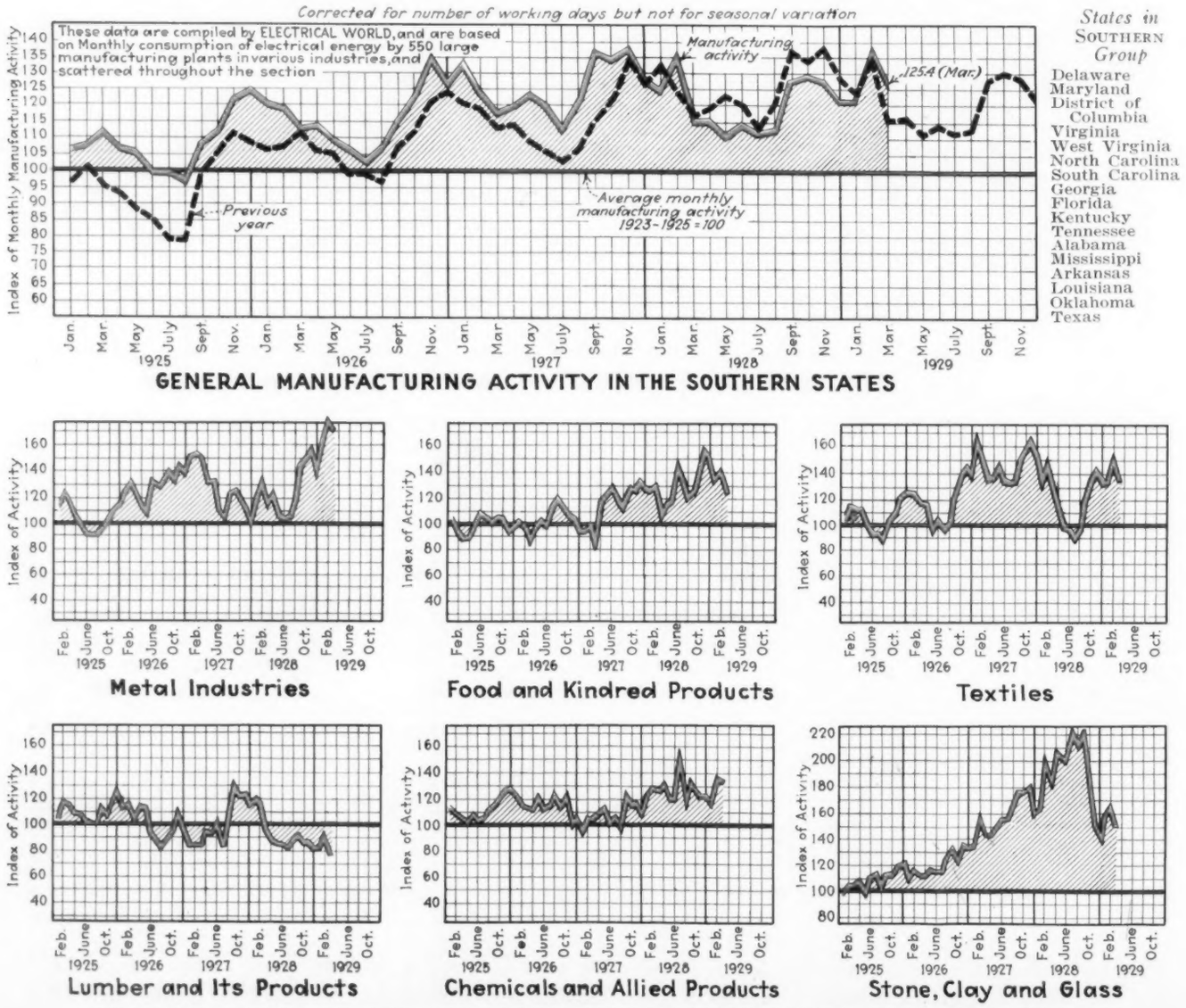
March manufacturing operations, after corrections are made for the number of working days, were 9 per cent under February, but were 8.7 per cent over March last year. The average rate of operations for the first quarter of the current year was 2.3 per cent over that witnessed during the same period last year.

The forest products industry continues to report a rate of operations under that of the same month in the year previous. This industry has been in the doldrums since February last year, the decreased operations having undoubtedly been due in large part to the decreased construction of dwellings throughout the country.

The textile plants of the South have been operating on a comparatively high plane since last October, reaching the peak of operations in February. The March rate of activity was 15 per cent under February, but was 9.7 per cent over that of March last year.

Index of Productive Activity in the Southern States

Average Monthly 1923–25 = 100
All Figures Adjusted for Number of Working Days

	March, 1929	February, 1929	March, 1928	Average First Quarter, 1929	Average First Quarter, 1928
All industry	125.4	137.7	115.4	127.8	125.0
Metal industries group	182.0	203.0	116.1	181.7	121.9
Rolling mills and steel plants	235.2	256.5	131.6	228.1	138.4
Metal working plants	123.7	144.0	100.6	130.3	105.3
Food and kindred products	125.7	141.0	106.8	132.3	120.3
Stone, clay and glass	151.8	163.8	178.0	153.2	179.2
Textiles	135.5	153.2	123.6	141.4	133.7
Paper and pulp	154.7	142.0	142 0	144.3	141.4
Forest products	78.9	93.3	95.3	84.5	110.6
Fertilizer industry	85.2	238.5	91.1	169.9	112.1
Shipbuilding	92.8	107.4	.....	96.0	.....
Chemicals and allied products	133.0	139.0	.....	129.7	.....
Rubber and its products	165.8	182.2	.....	169.3	.....

ELECTRICAL WORLD *Barometer of Industrial Activity in the Southern States*